Defects in Plumbing and Drainage Work

described by Francis Vacher

upwards of 100 illustrations

John Heywood
London & Manchester.

With the Author's compts.

DEFECTS

IN

PLUMBING & DRAINAGE WORK.

DESCRIBED BY

FRANCIS VACHER.

ILLUSTRATED BY UPWARDS OF A HUNDRED WOODCUTS.

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LONDON.
1889.

PREFACE.

MEDICAL OFFICERS OF HEALTH, in the ordinary course of their daily duties, not unfrequently meet with examples of plumbing and drainage work which are ill-planned, or ill-executed, or both. Early in 1885 it occurred to me that if all such instances of bad work were briefly noted when observed, and a record kept of them, they would furnish interesting material for a column in some current publication, lay or professional. I accordingly printed a note in the *Health Journal*, a small monthly periodical till lately published by Mr. Heywood, inviting medical officers of health and inspectors discovering any defect in domestic sanitary fittings, drainage, or water service to write a description of the same, and send it, with a rough diagram, to me. My invitation was responded to, and thus, with instances of bad work communicated to me, and examples noted in my own district, I was generally able to find material enough to fill my column of "defects." In this manner ninety-one defects were described and illustrated in the pages of the *Health Journal*, many of my notes and illustrations being subsequently reproduced in other periodicals. These ninety-one examples of defective work, together with twelve others, which I have since observed or received advice of from correspondents, form the substance of the present little volume. I have placed them in groups, for convenience of study, but this is an arbitrary and unscientific arrangement, as an example often shows many defects, and with equal fitness might be classed in two or three groups.

In making extracts from the *Health Journal* I have erased the names of the correspondents from whom the communications were received, as well as the names of the sanitary districts in which the defects were noticed. This appeared to me desirable, as when the defects are gathered together in a book, they will probably come under the notice of a much wider circle of observers than heretofore, and it would be most unfortunate if districts from which officials have sent some instances of insanitary plumbing or drainage should be prejudiced on that account. The fact that a district is served by an officer who can see defects is a good warrant for an inference that those defects will be remedied. However, the public do not always view such matters in a

true light, and, doubtless, cherish the delusion that there are places where plumbing and drainage defects are unknown.

Though I have no reason to believe that I or my correspondents have plumbed the lowest depths of the wickedness, or ignorance, or carelessness, of bad workmen, I have at least succeeded in collecting some curious particulars of ill-designed and "scamped" work. Many of my examples will be within the everyday experience of medical officers of health, architects, &c.; others afford illustrations of perverted ingenuity which, I trust, is exceptional; and a few are, probably, quite unique.

It is important to state definitely that all my examples are really modern instances of bad work—each example being noted by me or communicated to me during the last four years. They are not old instances of legendary bad work, vamped up for the purpose of making a more imposing show, but a true record of cotemporary defects noted and vouched for by trained observers.

The remarks I have placed at the beginning of each section or group of examples are in every case necessarily very brief—bare introductions to the sections only. For these and for every part of my little book, whether original or communicated, I hold myself responsible. I give my word for the good faith and competency of my correspondents; but if any of them had sent me a description of a defect which I did not recognise as a defect I should not have inserted it. All I have inserted I am prepared to do battle for. Thus, I may be informed that the arrangement for ventilating a drain by a rain pipe, as shown in Fig. 9, is approved by several sanitary authorities throughout the country. I shall not deny it, but still maintain that it is a defect. I may be told that the method of dealing with a sink waste pipe, shown at Fig. 26, is advocated by a distinguished engineer. I do not dispute this, yet the method is wholly bad. Again, I may be told that delivering a bath or lavatory waste pipe, as indicated in Fig 37, is approved of in model bye-laws. Possibly so. However, a waste pipe thus treated often causes a great nuisance.

In conclusion, I have only to offer my very grateful thanks to all who have helped me in producing this little picture-book of blunders. Without such aid there could have been no book; and I trust the public will show its gratitude to me and my fellow-workers by buying it and studying it.

FRANCIS VACHER.

Birkenhead, March, 1889.

ADVERTISEMENT.

LEST there should be any doubts as to whom this little book is addressed, I hereby formally commend it:—

To Householders, that they may be awakened to a sense of the possible dangers that lurk beneath well-made floors and neatly-papered walls. It is significant that a large proportion of the defects described are in the houses of the well-to-do.

To Medical Officers of Health and Sanitary Inspectors, as it cannot but prove useful to them, and occasionally furnish a hint as to the direction in which the cause of effluvia may be found.

To Plumbers, and those who Contract to do Plumbing and Drainage Work, that they may see the very great need there is for the better technical training of masters and journeymen.

To Teachers of Plumbing, &c., and their Pupils, as there are no text-books which will give just the information given here. Next in importance to being taught what to do is being taught what to avoid doing.

CONTENTS.

[Those marked * have not appeared in the *Health Journal* or elsewhere.]

V.—WATERCLOSET FITTINGS.

VI.—VENTILATING SOIL PIPES.

VII.—HOUSE DRAINS.

VIII.—DOMESTIC CISTERNS, HOT AND COLD WATER APPARATUS.

DEFECTS IN PLUMBING AND DRAINAGE WORK.

I.—RAIN CONDUCTING.

THE conducting of rain from the roof of a building would appear to be a perfectly simple task, and one which an intelligent mechanic might safely be trusted to accomplish. At no remote date it was commonly held to be carpenters' work; and though none can regret that wooden gutters and spouts are things of the past, the fact that many are still in evidence proves that they were often well made and served their purpose fairly well. It has now sometime been the practice to

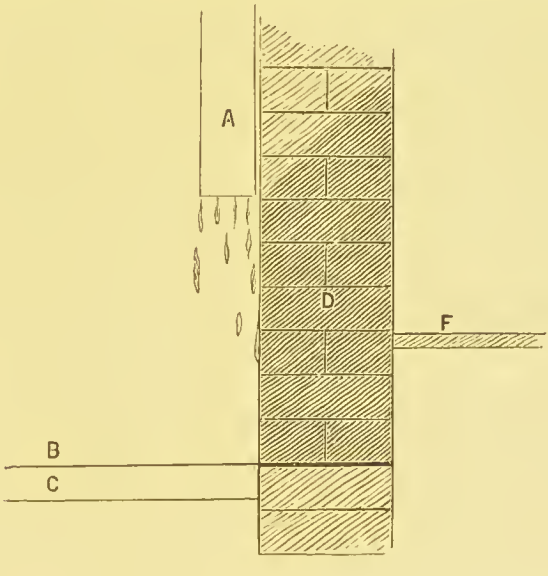


FIG. 1.

use metal pipes and gutters, and the tradesman employed to fix them is usually a plumber.

The more obvious requirements may be stated as follows:—

1. That the materials used should be of good quality and free from flaws.

2. That every gutter should be securely and properly fixed, of sufficient capacity, and have sufficient fall.

3. That every rain pipe should be securely and properly fixed on the outside of the building, that it should be of sufficient capacity, and deliver on a trap or channel, or into a receptacle for collecting rain water; never in any case being utilised to ventilate a soil pipe or sewer.

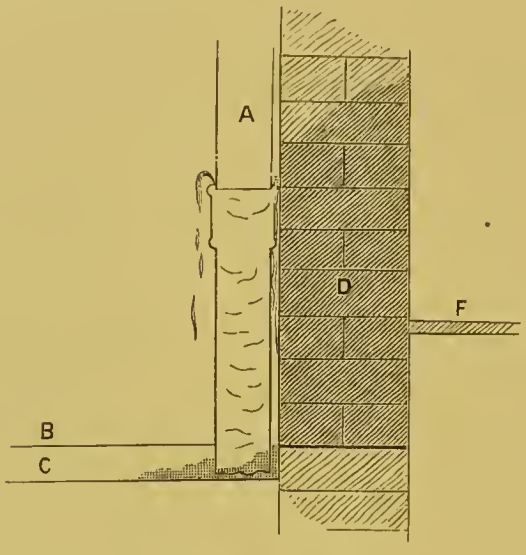


FIG. 2.

The examples of bad work as regards rain conducting herewith submitted will show that these requirements are not always kept in view.

Figs. 1 and 2 illustrate the negligent way in which rain spouts are fixed, and the resulting nuisance from damp. The examples are taken from two new houses in a new street.

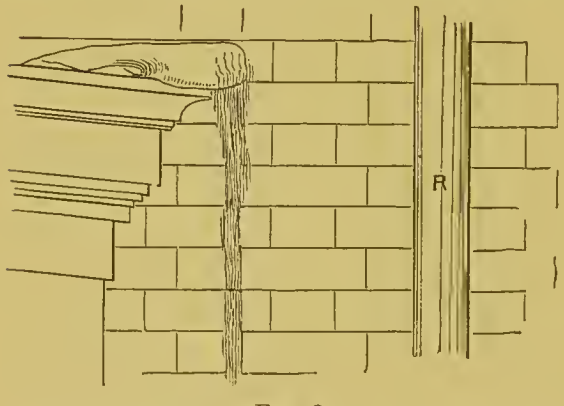


FIG. 3.

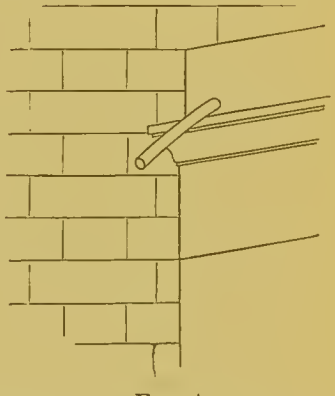


FIG. 4.

Fig. 1 shows the rain spout terminating 18in. above the surface of the pavement, and consequently discharging large quantities of rain directly on the wall of the front parlour.

Fig. 2 shows the spouting continued by a length which has been broken off too short, and fastened too low. The end being

deep down in the rain-water conductor in the pavement, sooner or later becomes choked, and then the water overflows at the first joint. As the end of pipe A was only within the socket of the pipe below for $\frac{1}{8}$in., and the joint was quite open, there was nothing to check the discharge of rain on the wall. In both

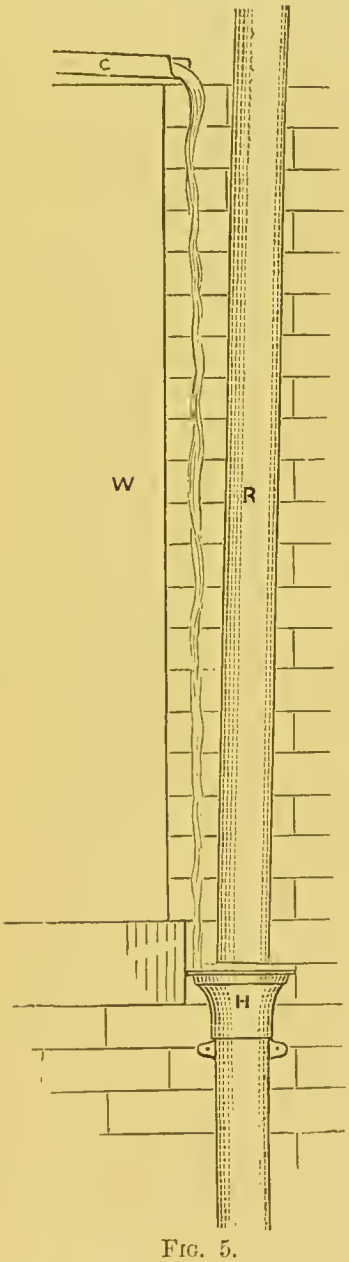


Fig. 5.

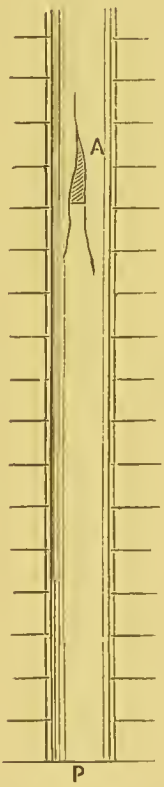


Fig. 6.

Fig. 7.

Figs. A is the rain spout, B the surface of the pavement, C the surface of the sunk rain-water conductor ($2\frac{1}{2}$in. deep), D is the damp portion of the front wall of the house, and F is the parlour floor. The houses are workmen's cottages, letting at seven shillings and sixpence per week.

Figs. 3 and 4 represent defects lately brought to my notice in a row of new buildings. The bay windows in the front of four small houses have the rain conducted from the roofs, as shown in Fig. 3. In each house a piece of lead, cut too large for the window, is rolled up one side, and conducts the rain on the front wall, where it has already left a large stain. A rain spout R, terminating in a channel in the pavement, passes close by. The bay windows in front of the remaining six houses in the same row have the rain conducted from the roofs as shown in Fig. 4. The lead-covered roof of each window is provided with a short lead pipe, which pierces the coping stone, and delivers, as shown, like a warning pipe.

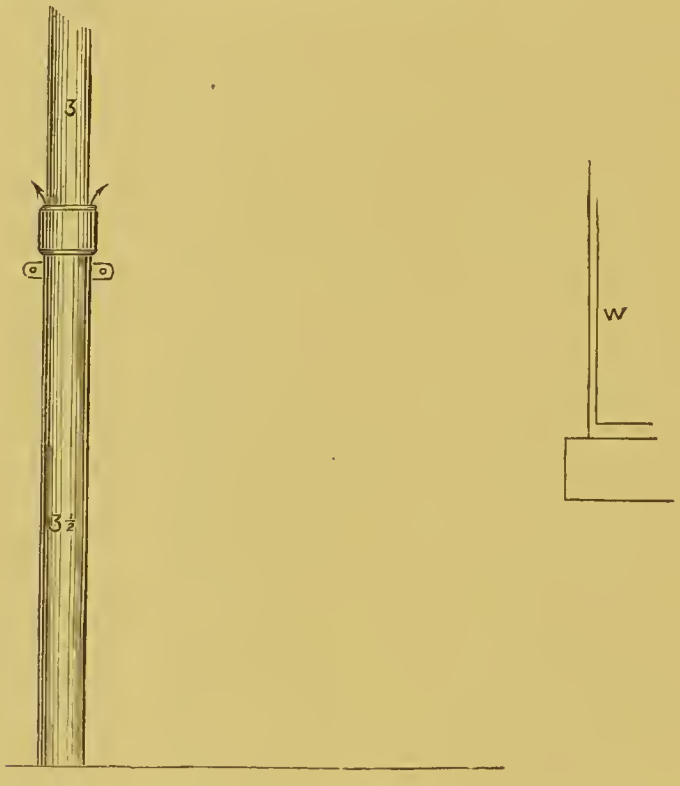


Fig. 8.

Fig. 5 shows a clumsy arrangement for carrying off the rain from a house. C is the termination of a rain gutter, gathering from upwards of 130 square feet of slates. Instead of being conducted to the rain spout R, gathering from another part of the roof, it discharged into a rain-spout head H, 5¼ft. beneath, causing a nuisance from damp along the wall by the side of the window W, and splashing at the corner of the window close to H.

Fig. 6 indicates a defect I noticed lately. In the wall of a new building, flush with the street line. is a chase containing a 4in. iron rain spout. In this is a double crack, 13in. long, and this crack has lately been converted into a hole 1in. across at

the bottom and 5in. long, as shown at A. The hole, being 3½ft. from the pavement P, causes a nuisance to foot passengers. The flaw was in the pipe originally, and could hardly have escaped the notice of the builder and his employés, and yet the pipe was accepted and used.

Fig. 7 represents a 3½in. iron rain pipe, which was recently shown me after removal from a house rated at about £30 a year. This pipe was carried down inside the house and made to deliver into a 6in. earthenware drain, a junction pipe being provided but the joint being left unmade. When the rain pipe was removed it was found that at the side next the wall it was cracked from end to end (6ft.). In all probability the pipe was sound when fixed, and owing to a stoppage at the bottom had got full of water, which had become frozen and produced the fracture. Placing the pipe inside the house was wrong, connecting it

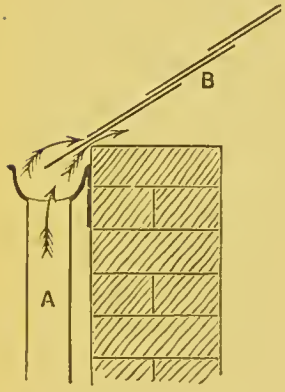


Fig. 9.

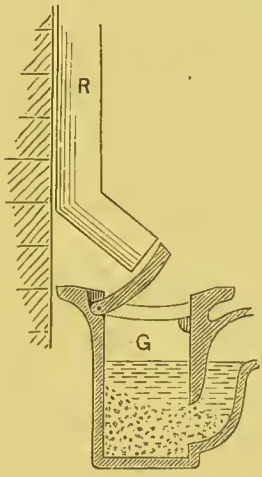


Fig. 10.

Fig. 11.

directly with the drain was wrong, and failing to make a proper joint was wrong. The result was that the noxious air from the drains had free access to the house, as shown by the arrows in the cut, and that the wall to which the pipe was fastened was rendered damp.

Fig. 8 shows an arrangement for conducting rain from an artificer's cottage which I took a note of. The lower length of the rain pipe, which was directly connected with the drain, was 3½in. in diameter, and the lengths above 3in. in diameter, the joints being unmade. It will be seen that when foul air ascended from the drain, part of it was delivered in front of the cottage, but three feet from a window often open. It seems strange that pipes of different sizes should be used, as in this instance. The explanation suggested is that the petty tradesman employed on the job had not enough pipes of one size, and, to avoid the trouble of sending for what he required, used what he had in stock.

Fig. 9 is the section of the top of a wall, the slates, and rain gutter, and shows how a rain spout, carried straight into the drain, delivers gases from the drain into the house. To simplify the illustration, the framework of the roof is not indicated. B is where this framework would be; A is the 3in. rain spout made of sheet iron, and well jointed and connected to the gutter; and the arrows show how the gases find their way under the slates into the house.

Fig. 10 illustrates a defect I saw recently, and I have frequently seen similar defects in sink-waste disconnections. In a detached villa in the suburbs the rain spouts are brought down to deliver on gully traps, in the manner shown. The grating of the trap is hinged, and made to open to a right-angle with the mouth of the trap, in order to allow of the trap being systematically cleansed. The end of the rain spout is fixed so close to the trap that the grid cannot be opened except to an angle of about 35 degrees, and the result is that it is almost impossible to cleanse the trap efficiently. As the rain spout is cast iron, the outflow of the trap is almost choked with rust. R is the rain pipe, and G the gully trap.

Fig. 11 shows a 3in. iron rain spout delivering into an ashpit. The spout receives from the back portion of the roof: thus about half the rainfall is directly conducted into the ashpit. The result is that after wet weather there is an effluvium nuisance from the ashpit, and the contents are usually saturated.

II.—TRAPPING YARD AND AREA DRAINS.

EVERY yard drain and area drain should be trapped, otherwise noxious vapours and gases ascend therefrom and pollute the air round the house. The trap ordinarily used for the purpose has a receptacle which will retain sufficient water to seal up the entrance to the drain.

The more obvious requirements may be stated as follows:—

1. That every trap (usually made of iron or glazed earthenware) should be of good quality and free from flaws.

2. That every trap should have a seal of not less than 2½in. in depth—that is to say, more than 2½in. in depth of water must evaporate before the water seal would be broken.

3. That the entrance to every trap should be provided with a grating or perforated lid, opening outwards to allow the trap to be readily cleansed.

4. That every trap should be set level, and securely jointed to the drain it is to guard.

The examples next submitted show these requirements are neglected in various ways.

Fig. 12 represents a so-called box trap. When discovered, it was supposed to be trapping the yard drain belonging to a house in an important thoroughfare in the centre of the town. The sketch is half the size (linear) of the original. In the section, A is the lid, perforated with sixteen small holes, and carrying the useless box B on the under surface; C is the reservoir of water 2¼in. deep, into which the box should dip, but which it does not touch; and D is the outflow from the trap leading to the drain. The upper part of the cut represents the lid turned upside down, the inner dotted line being a plan of the mouth of the trap outflow, The trap is of cast iron, and in all probability hundreds of the same casting have been sold.

Fig. 13 is a section of another trap my attention was called to. It was fixed in the rear of a house bearing a rental of about £65, and was properly connected to the drain, and certain waste pipes delivering on it kept it well charged with water. However, on examining it, the trap was found to be a delusion, the water standing one inch too low to form a seal. Of course the gases and effluvia in the drains were thus brought close up to the dwelling-house, and delivered immediately under the scullery windows, &c. It may be said that as the workman

had set the trap quite square, and made good connections, he was not to blame. This is to take a very low view of a workman's duties. The primary defect was certainly in the casting, but surely no intelligent workman does his duty who fixes a trap without first testing it.

Fig. 14 shows the uselessness of trapping a yard drain with a loose trap of any pattern. The trap shown is a so-called dish

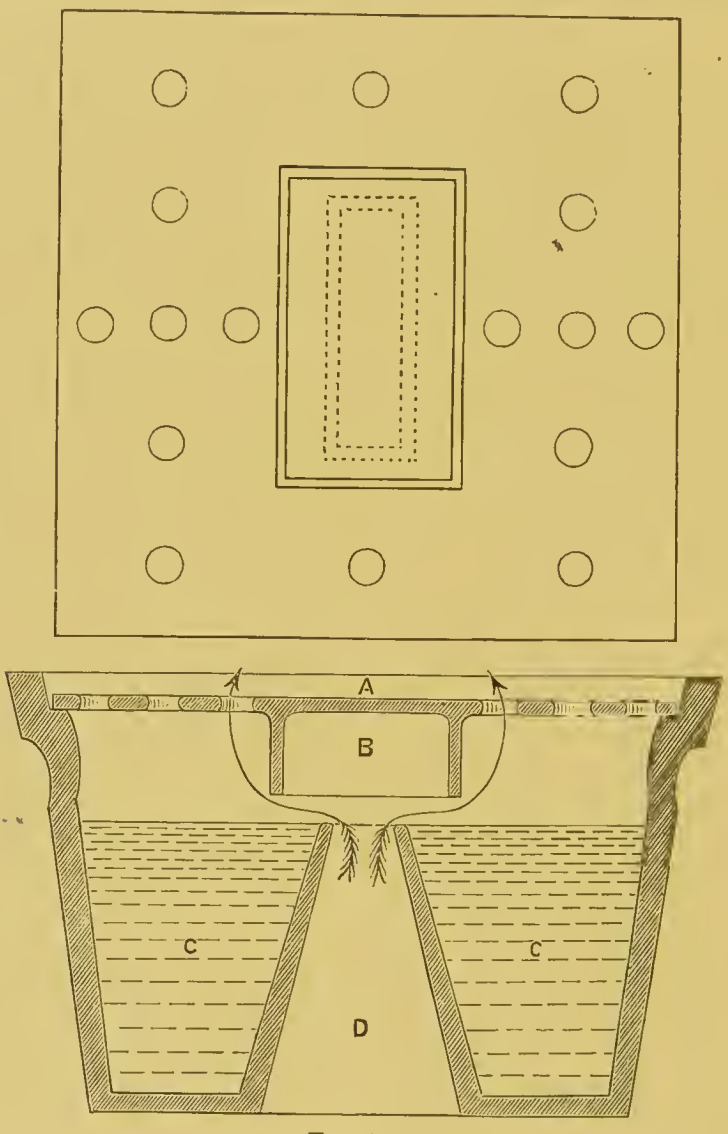


Fig. 12.

trap made of cast iron. It very easily gets choked, and for this reason it is commonly inserted without any setting, so that it may be taken up and cleansed. Any gases or vapours in the drain are not, of course, kept back, but find their way out external to the trap on all sides, as indicated in the illustration. The trap shown was found on premises owned by well-to-do

people, who would hardly have objected to the cost of providing and fixing an efficient gully trap, if the defects of the loose trap had been pointed out to them.

Fig. 15 shows another form of opening into a yard drain. The drain was of 4in. earthenware pipes, as in the last case, but

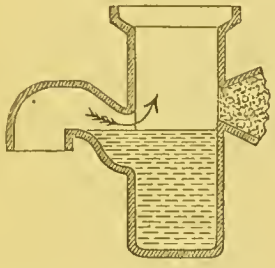


Fig. 13.

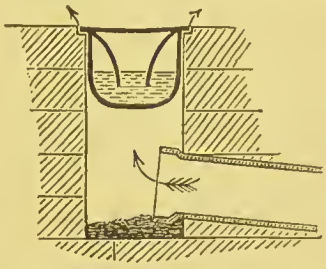


Fig. 14.

the mouth was not protected by any trap at all but only by a perforated stone.

Drains discharging direct into the sewers, and carrying foul air therefrom into the backyards of dwelling-houses in one or other of these ways, are not unfrequently noticed.

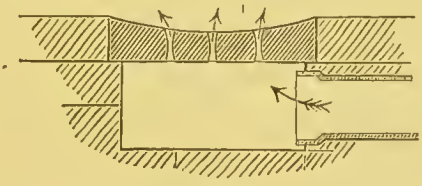


Fig. 15.

A defect less frequently met with is illustrated in Fig. 16. This trap, like all small D traps, holds too little trapping water to be secure, even had it been properly set. However, the workman who fixed it had done his work so negligently that, owing to uneven setting, the water seal was completely broken.

Fig. 16.

Such a blunder as this could hardly be made except in a yard paved with small boulders or badly levelled.

Fig. 17 represents the trapping of a yard drain as done by a local tradesman. A notice had been served on the owner of a small cottage dwelling to provide a properly trapped yard drain

and I called to see if the work had been done. The tenant said the workmen had finished the job a day or two ago, and took me into the yard. Here was the new glazed earthenware trap, but as it did not hold water, even when freshly poured in, I had

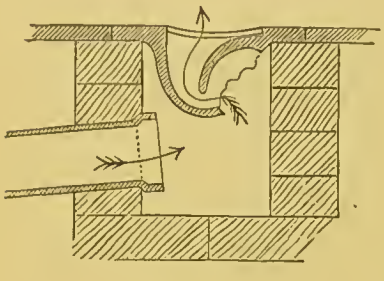


Fig 17.

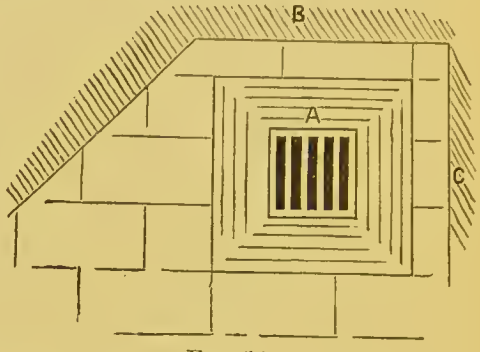


Fig. 18.

it removed. There was a large hole in the back, as shown in the cut. I questioned the tenant as to whether anyone belonging to the house had removed the trap and broken it, and he said the trap had not been touched since the workmen left. The only course open to me, therefore, was to believe that

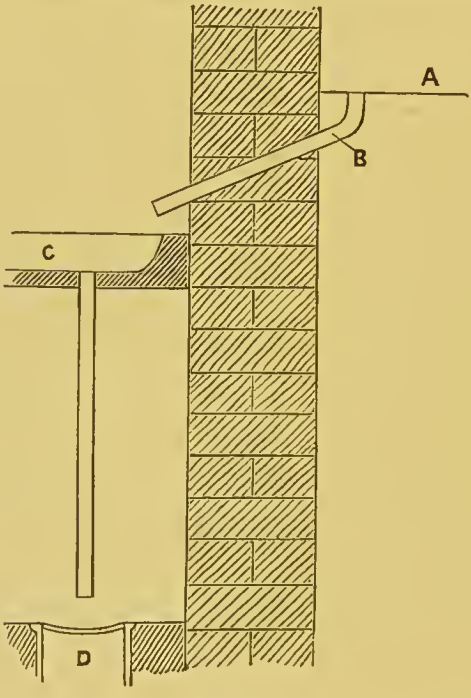


Fig. 19.

a tradesman had been guilty of the fraud of selling and fixing a broken trap.

Fig. 18 shows a dummy area drain. Damp was complained of in the front wall of a kitchen. The area was paved with brick, and in the corner where the damp was noticed was a

stone collar and iron D trap. On the trap being taken up it was found to deliver its contents on the earth beneath the bricks, and the water had soaked through an 18in. wall into the kitchen. A represents the trap, B the kitchen wall, C the area wall. The workman who inserted this trap was guilty of a deliberate piece of wrongdoing; for the house was one of many in a terrace, an area drain was provided, and the corresponding traps in the houses on either side were connected.

Fig. 19 is the section of the wall of a back kitchen. A represents the bottom of an area, C a sink-stone, and D a trap for the back kitchen drain on which the sink waste pipe discharged. Instead of draining this area in a proper way it was drained to the sink-stone by a short lead pipe B. What first led to this part of the house being examined was an effluvium nuisance in the back kitchen, which was traced to the trap D. The trap was obviously sealed with a decomposing animal liquid, and the readiest explanation of this seemed to be that the area had been used after dark for a purpose for which it was certainly not intended.

III.—SINK WASTE PIPES.

DEALING with a sink waste pipe is in most cases a very easy matter. The situation of the sink is nearly always against an external wall, and the sink waste pipe has to be taken through this wall, and made to deliver on or into a trap outside. It is also desirable to trap the waste pipe before it is carried through the wall, as if this precaution be not taken, anyone using the sink will be annoyed with cold draughts and a bad smell from the foul inside of the pipe. The most suitable trap for this purpose is a S trap, as shown in Fig. 21.

Thus there are two obvious requisites in treating a sink waste pipe :—

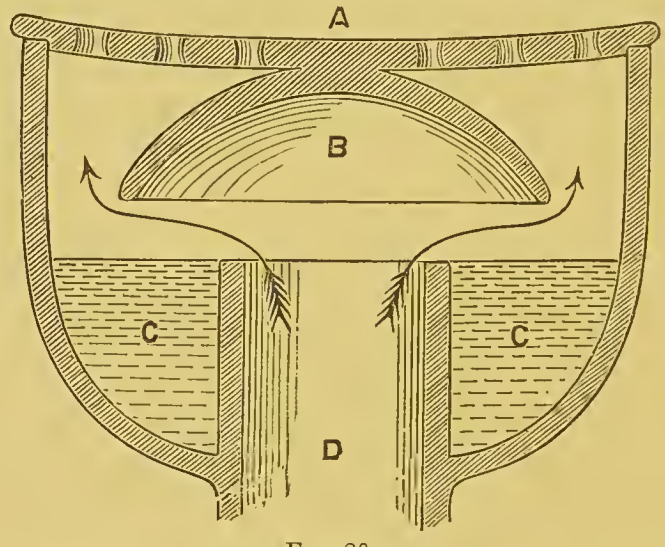


FIG. 20.

1. That the sink trap should be perfect, giving a water seal of not less than 2½in.; that it should be securely fixed, and have an access hole, to cleanse it, provided with a screw stopper.

2. That the waste pipe should be disconnected on a trap having sufficient water seal, external to the house if possible, and if not, under or conveniently near the sink.

Fig. 20 shows a typically bad bell trap I discovered in the scullery of a house rented at £30. I examined it with great care, and then drew the section given, the exact size of the original. A represents the perforated grating, B the bell, CC the water reservoir—which the bottom of the bell never could have reached—and D the portion of the trap which was continuous with the sink waste that went straight into the drain. It will be seen that the whole apparatus is simply a pretence,

the depth of the bell at the centre being barely half an inch, and the distance between the bell rim and the surface of the water being just a quarter of an inch. On the same day, in the same street, I examined a sink bell trap in another house, and found the

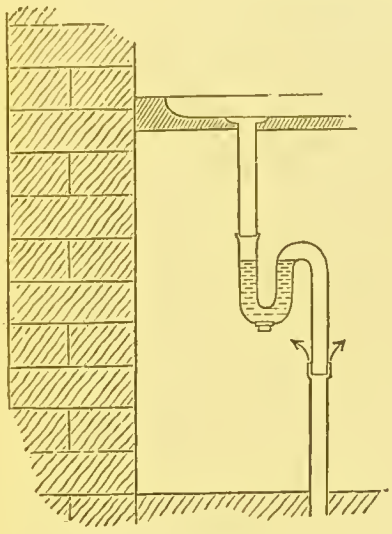


Fig. 21.

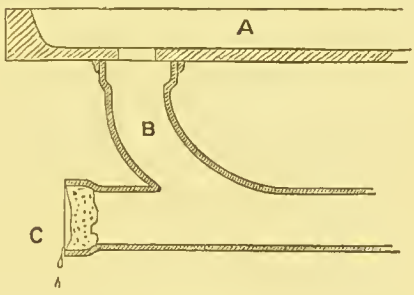


Fig. 22.

depth of the bell at the centre three-eighths of an inch. These were not traps the bells of which had partly corroded away by means of the action of water on iron, but nearly new traps, absolutely useless when fixed.

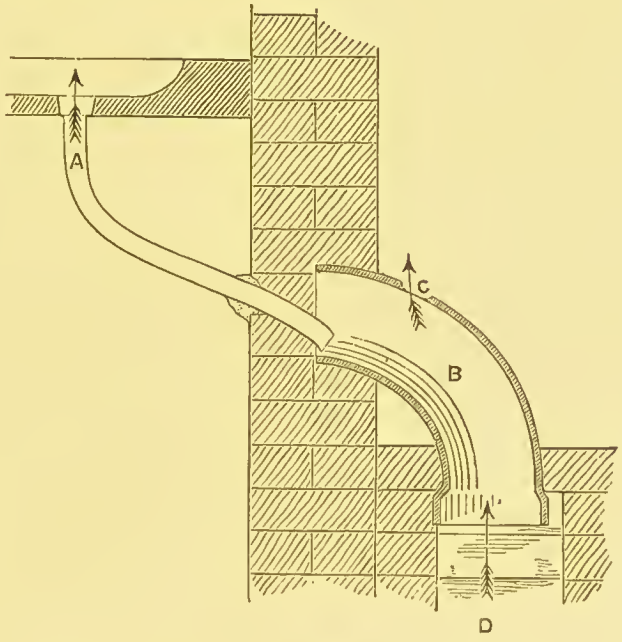


Fig. 23.

Fig. 21 indicates a sink waste pipe and its trap to which my attention was called. Being in a dark corner, it at first appeared to be a satisfactory fixing, but when closely examined it was

found the sink had a *movable trap*. The pipe to receive the lower end of the trap had been bulged out for barely an inch, and in this the lower end was placed, there being no trace of a joint of any kind having been made. The upper part of the trap had been widened out for a quarter of an inch, just enough to retain the trap in position. I have no doubt the trap had been fixed in this way to allow the tenant to clean it out at pleasure, but this was quite uncalled for, as there was access to the trap at the bottom of the bend, in the usual way. It is needless to say the arrangement was worse than having no trap at all, as it gave the householder a false sense of security. The arrow heads in the cut show that the trapping water trapped nothing.

Fig. 22 shows a sink in the basement of a house rented at £45. The sink had been fitted with a bell trap, but this was lost. On making an examination beneath the stone it was found

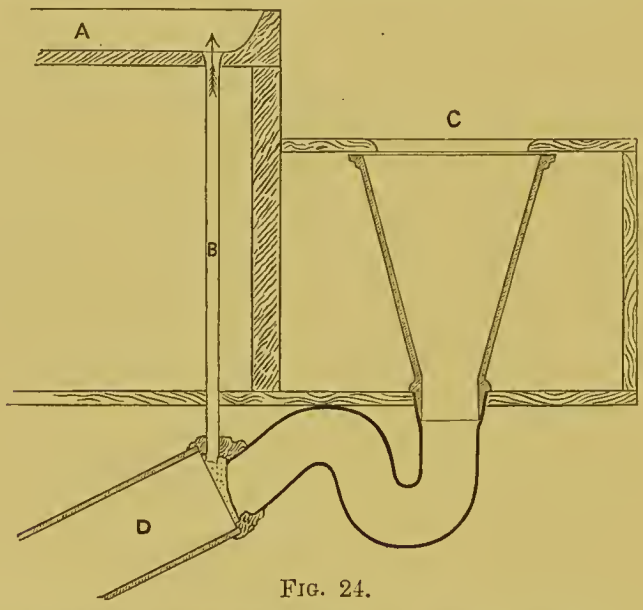


Fig. 24.

that the sink waste was a 4in. earthenware junction pipe. A is the sink, B the pipe, and C the end which was imperfectly stopped, and through this stopping the foul water was leaking on the floor.

Fig. 23 represents a direct connection between a scullery and the external drains by means of the sink waste pipe. Such connections are common enough, but in the case referred to it was effected in such a clumsy unworkmanlike way, I made a sketch of it. The lead waste pipe A was taken into a 6in. earthenware curved pipe B, and this was connected to the drain D. At C a rough hole had been made in the pipe B, so that the noxious gases and vapours from the drains were admitted not only into the scullery but into the yard. This had apparently been done as a means of ventilating the drains, and

to abate the effluvium nuisance in the scullery. The arrangement described was observed on inspecting two small cottage houses tenanted by working men. A similar arrangement, but without the ventilating hole C, was noted in adjoining houses.

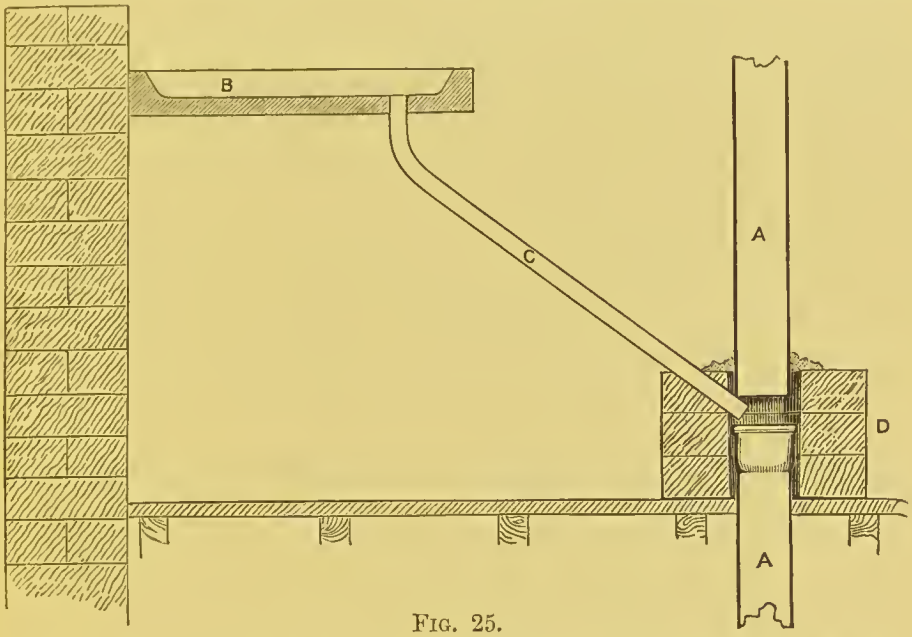


Fig. 25.

Fig. 24 represents a sink-stone and watercloset, which were placed side by side, as shown, within a scullery. The watercloset was *without water supply*. The closet basin was placed

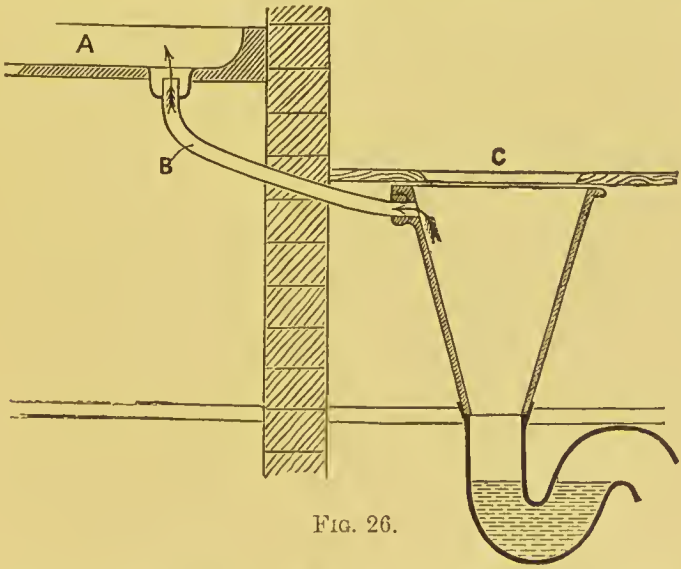


Fig. 26.

over a syphon trap, which would frequently become choked, and this syphon trap and the sink waste were connected to a 6in. earthenware drain. A is the sink, B the untrapped waste pipe, C the closet, and D the drain.

Fig. 25 represents an instance of badly-planned and badly-executed work. The defects will be obvious at a glance. A is an iron soil pipe from the closet above, running through the centre of the house to the drain in basement; B is a sink situated on an upstairs landing; and C is the sink waste pipe directly connected with the soil pipe A. It will be seen that the upper length of the soil pipe is not placed well down in the socket of the length of soil pipe below, and properly jointed, but that there

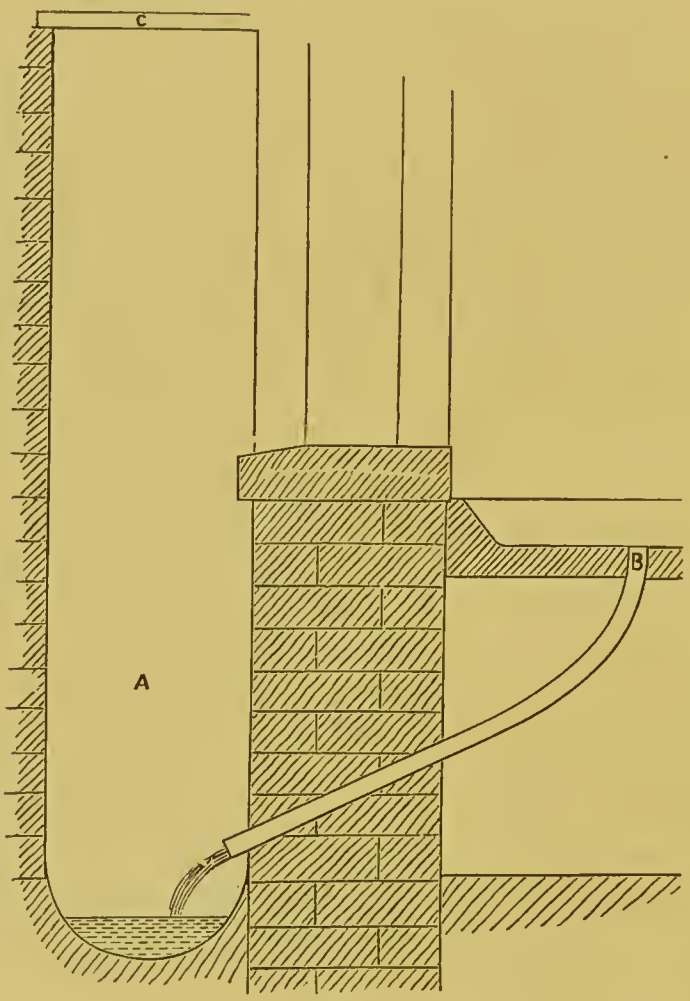


Fig. 27.

is a distance of nearly two inches between the lengths to admit the end of the sink pipe. D is a mass of brickwork built round the imperfect jointing. As there was no intercepting trap between the soil pipe and the main sewer, sewer gases had ready access to the centre of the house.

Fig. 26 shows an arrangement rather less dangerous to health and life than the one just referred to, but still horribly disgusting. A is a sink-stone, the waste pipe B of which is directly connected to the basin of closet C adjoining. The

end of the waste pipe had once been protected by a bell trap, but the top was lost when the premises were visited. The effluvia from the closet basin were directly conveyed to the sink-stone, and the only water the closet had to flush it was the more or less greasy slopwater poured down the sink.

Fig. 27 shows a sink in the basement drained into an air drain. The house in which I noticed this defect was a hand-

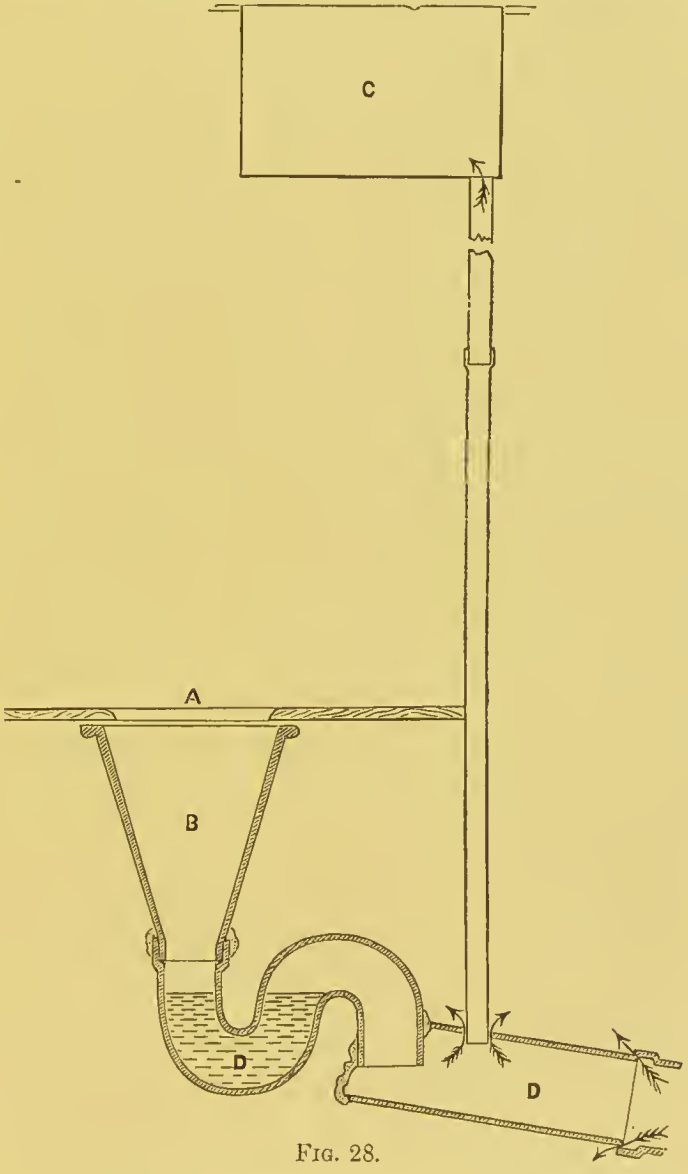


Fig. 28.

some suburban villa, exceedingly well built and provided with many modern conveniences. Round the house an area, or air drain, had been excavated, about 14in. wide, and this communicated with the air by iron gratings situated opposite the basement windows. The bottom of the area was cemented over and finished off as a channel—the area draining, by a very slight

incline, to a trap placed in a scarcely accessible position. The result of disconnecting the sink pipe on this area was that foul soapy water collected in the channel, to the depth of some inches, and gave rise to an effluvium, which came into the house through the basement windows. A is the area, B the sink pipe, and C the grating at the ground level.

Fig. 28 shows what was discovered at a smaller suburban villa rented at £40. There was a complaint of effluvium nuisance, especially in the basement, and the examination of the premises was accordingly begun in the closet in the basement. Here was a basin of the usual pattern, properly connected to a 4in. glazed earthenware trap, and this again was connected to a 6in. glazed earthenware pipe, as indicated in the cut, the joint being not a workmanlike one, but made with cement, and apparently tight. The joint at the other end of the 6in. pipe was bad all round, and in the upper part of this 6in. pipe a hole had been drilled to receive a 1½in. cast-iron waste pipe. The cast-iron pipe was quite loose, and could be moved freely from side to side. Above was a butler's pantry sink, the lead waste pipe of which was directly connected with the cast-iron pipe. A is the closet seat, B the basin, D and D the trap and drain pipe, and C the sink. The escape of foul air was from the defective joint in the drain, the hole drilled in the drain, and the sink in the butler's pantry.

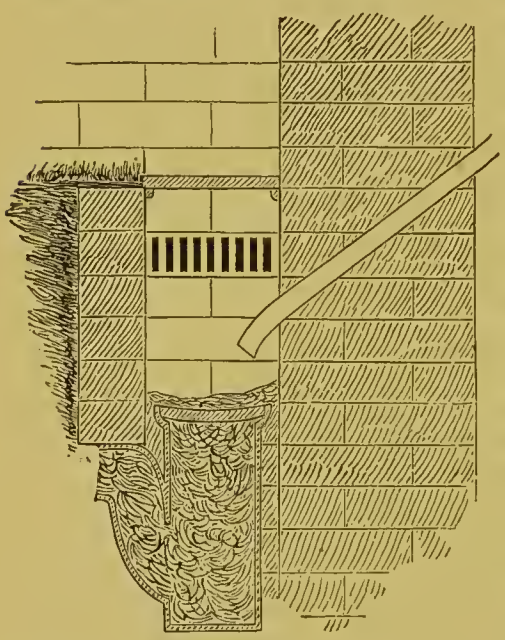


Fig. 29.

Fig. 29 illustrates a curious defect in another villa residence. Complaint was made that water was coming in through the external wall of a room in the basement used as a washhouse. A plumber was sent for, and it was found that the water came from an iron ventilator in the external wall, which had been put in to ventilate the basement. On the outside of the grating was a small area which had been made to receive the gulley trap on which the sink waste pipe delivered. As this area was covered by an iron grating, no attempt to cleanse it, or the trap it contained, had been made for a long time. The result was that the trap got filled to the brim with fat and other offensive matter; and then the foul water discharged by the sink waste pipe filled the area till it reached the level of the ventilator, and overflowed into the house.

IV.—BATH AND LAVATORY WASTE AND OVERFLOW PIPES.

A WASTE PIPE from a bath or lavatory should be treated as a sink waste pipe—trapped with a S trap, and then made to deliver on a gully trap outside the house. The overflow pipe in either case should be connected with the waste pipe between the bath or basin and the S trap.

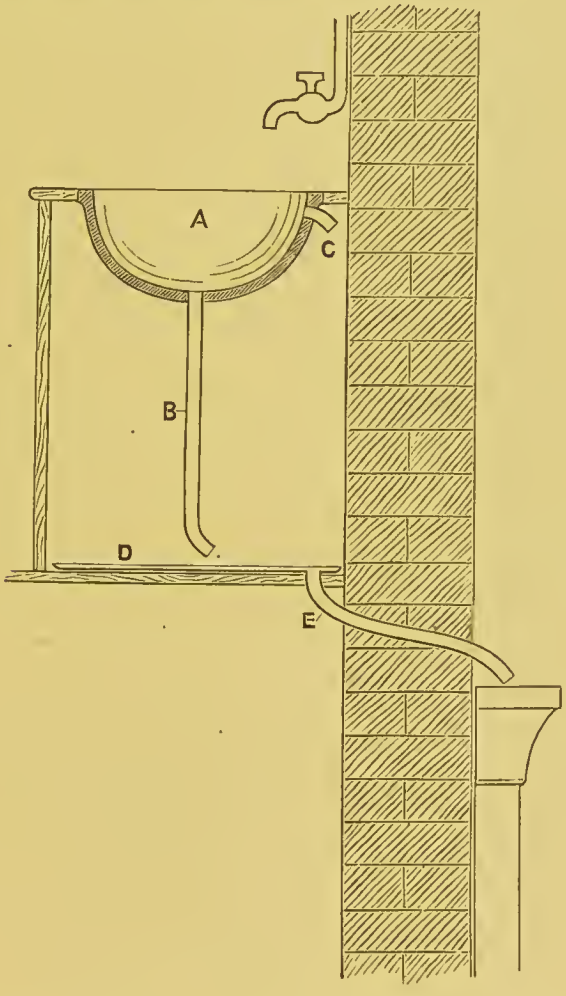


Fig. 30.

Fig 30 has been sent me by a correspondent, who writes me that he recently saw a lavatory basin as shown. It is in his experience a unique way of treating a waste pipe and overflow. The sketch explains itself. A is the basin, B the waste pipe from

the same, discharging on the "safe" or lead tray D, and C is the overflow from the basin, practically discharging on a wall. E is the waste from the lead tray delivering in a rain-spout head. Of course the lavatory wall was always damp, and gave out an offensive smell.

Fig. 31 shows a comparatively common defect. It is from a large building used as a hospital. A is a waste pipe from two hand-basins, discharging on a roof gutter B. The foul water from A runs along the open gutter for five feet before it reaches a downspout. Two feet above this gutter, which is ordinarily in a very foul state, is a window. Of course the proper practice

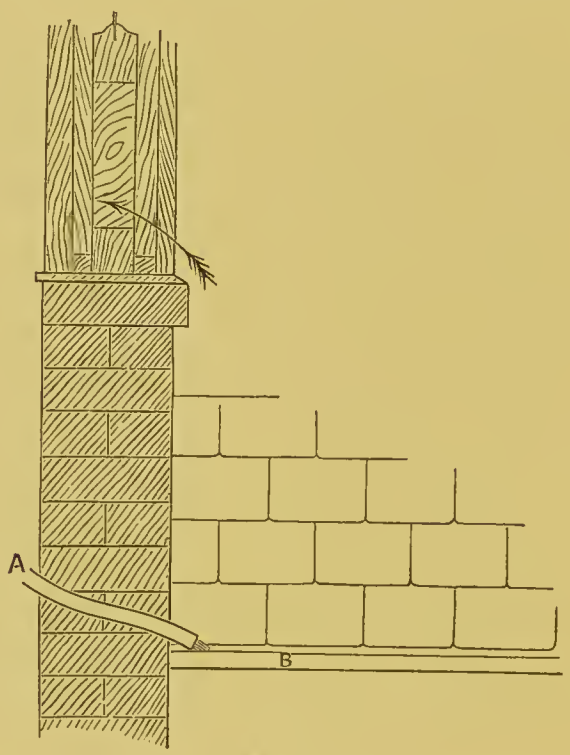


Fig. 31.

would have been to have brought the waste pipe down to the ground level and discharged it on a trap.

Fig. 32 illustrates the danger of an untrapped overflow pipe. A whole family occupying a house in a large town had been suffering from a low type of sore throat. The patient most severely affected had been making use of the bathroom as a bedroom. An examination of the premises, instituted by the medical officer of health, led to the discovery that though the bath waste pipe was trapped, the overflow pipe had been connected to the waste pipe between the trap and the house drain. Thus the overflow ventilated the drain into the bathroom. A is the bath, B the bath waste trap, and C is the overflow pipe.

Fig. 33 shows in section the upper end of a bath B, situated against an outer wall. There was an overflow pipe at A, taken straight out through the external wall along the outside towards a rain spout R, into which it delivered. Before being connected with the rain spout it was bent downwards and upwards so as to

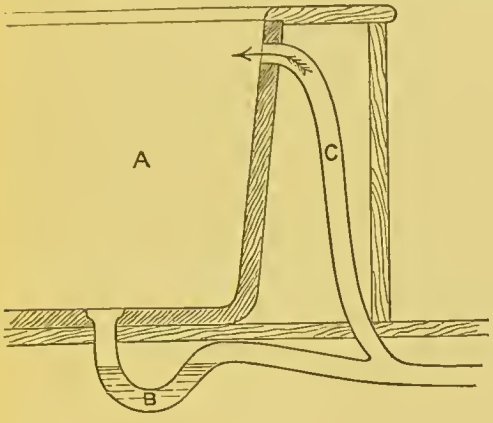


Fig. 32.

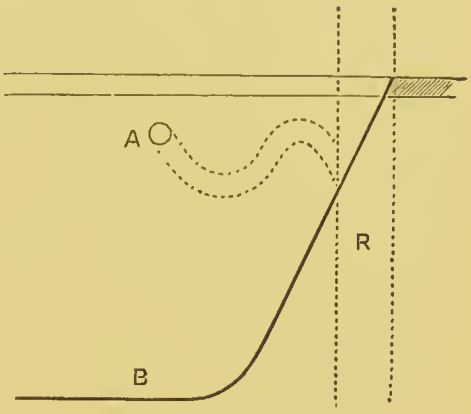


Fig. 33.

form a S trap. The rain spout was directly connected to the drain, and the S trap was empty, so that effluvia and noxious gases from the drains were conducted into the house and delivered close to the face of anyone using the bath. Of course,

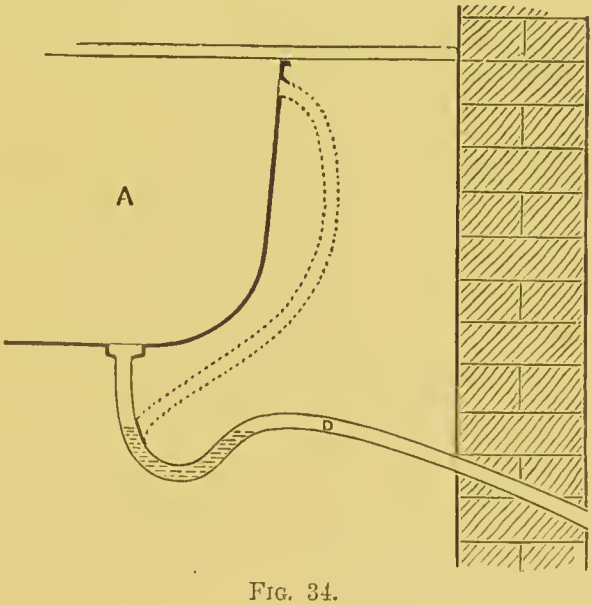


Fig. 34.

when the bath was being used the bathroom would be unusually warm, and abundance of foul air would be drawn up. It is needless to point out that a bath overflow pipe should be disconnected. Twisting the pipe in the form of a S trap is of little service, as a bath is rarely filled so full as to bring the overflow into use.

Fig. 34 illustrates a familiar defect. In a suburban villa (rent £85), lately built, the bath was found by the tenants to be without an overflow pipe. The bath waste pipe was trapped, and taken out at once, and delivered on a gully trap, and the other sanitary arrangements appeared to be satisfactory. A represents the bath and D the waste pipe, and the dotted lines indicate the position of the overflow pipe which should have been fitted.

Fig. 35 is a section of a closet, showing also a portion of a bath in an adjoining room. As will be seen, the bath waste is taken into the closet trap. There was a complaint of an effluvium from the bath waste, and when the closet was used there were puffs of foul air from the waste pipe. In the cut A is the closet seat, B the basin, C the container, D the trap, and E the pipe wrongly brought into the trap.

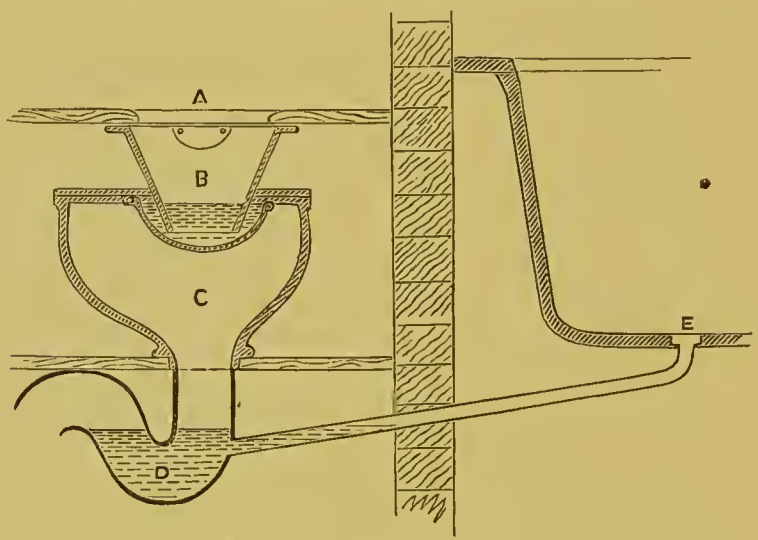


Fig. 35.

Fig. 36 requires little explanation. It represents work carried out by a competent plumber at his own house. A is a bath inside the house and B is the basin of a closet in the yard. These, it will be seen, are directly connected, the waste pipe from the bath being made to flush the closet. There was no other provision for flushing the closet, and as the pipe was untrapped, the foul air from the basin ascended to the bathroom, causing an effluvium nuisance.

The method of delivering waste water represented in Fig. 37 is, I regret to say, not uncommon. The bath and hand-basin waste pipes are brought outside to discharge on the area flags, which are channelled to conduct the water to a trap. Only one waste pipe is represented in the cut, but I have seen three together treated in the same manner. I have also seen the trap a yard or more from the end of the pipe; and sometimes no

channel or conductor to the trap is provided. In any case the result is a nuisance from the foul state of the flagging between the pipe and the trap, and effluvia commonly find their way into the house at the kitchen or pantry window. A is the waste pipe, B the area flagging, and C the trap.

Fig. 38 is from a correspondent. He writes: "During my inspection of the sanitary arrangements of an empty house of considerable dimensions, I found that a new bath had been fixed some six or seven months prior to my inspection, and the waste pipe from same connected to a rain-water downpipe, running

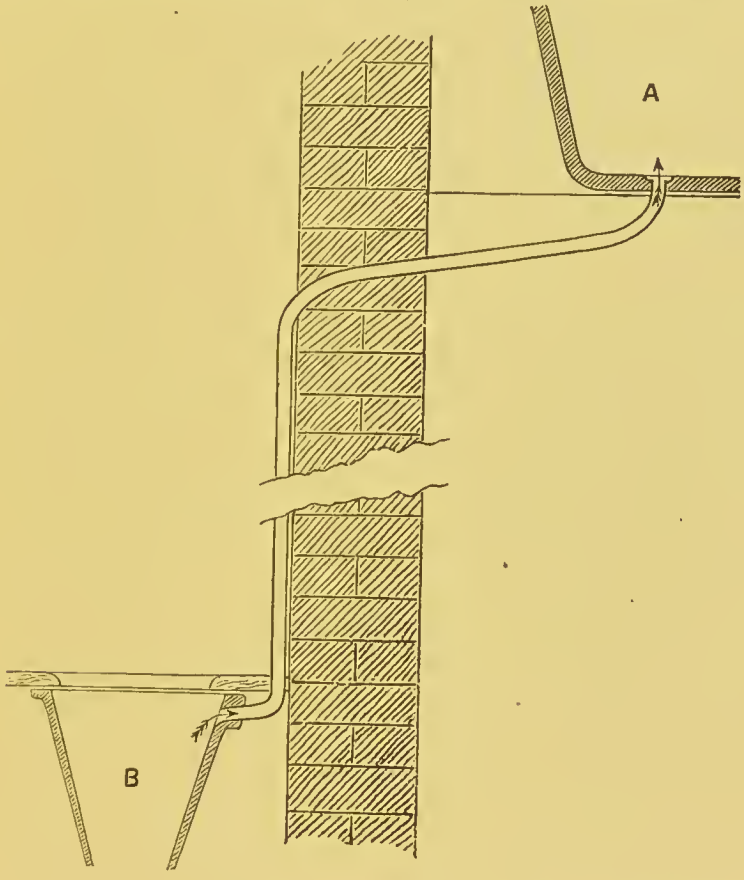


Fig. 36.

close by, for convenience. It seemed to me that the rain-water pipe was in communication with a tank under the house, some distance away, and accordingly I gave instructions for opening the tank, with the result I anticipated. The bath had been in use for three or four months before the house was vacated." In the figure B is the bath and A the rain pipe.

The following experience of a sanitary inspector shows how terra cisterns and tanks may become fouled with the most disgusting liquids, even where there is no direct communication between such a tank and a waste pipe. The inspector referred

to writes: "Having reasons to go on the roof of a large terrace house, a few days ago, I discovered, by certain unmistakable signs, that the domestic servants had for a long time been in the habit of throwing the slops of the upper part of the house

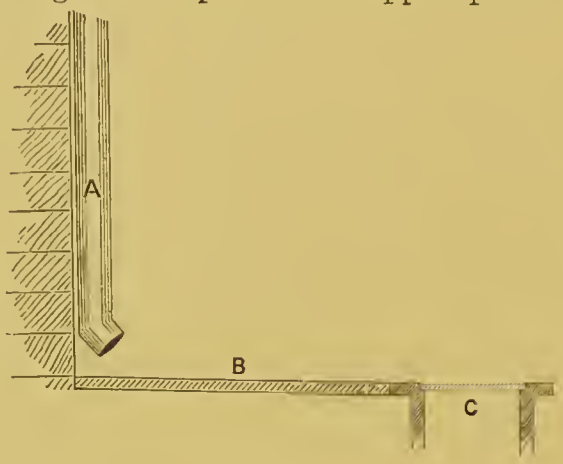


Fig. 37.

through an attic window on the lead gutter below. I traced the course of the gutter, and showed that the water from the same was conveyed to a pipe, descending through the centre of an adjoining house, to a tank under the kitchen of the said

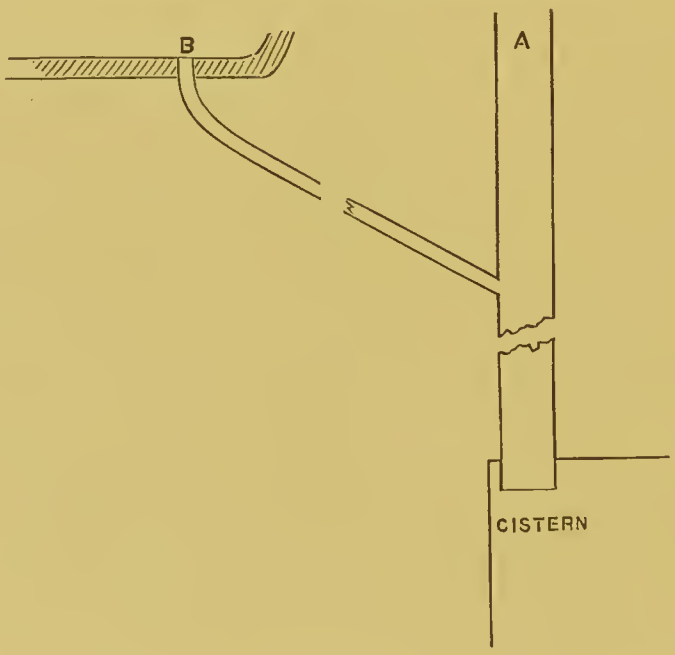


Fig. 38.

house, from which it was raised, for domestic purposes, by a suction pump."

Fig. 39 represents a soil pipe and bath waste pipe, as seen from the outside, in a villa residence I lately examined. S is

the 4in. lead soil pipe jointed to an iron one; V is a 2in. ventilator, terminating just under the projecting edge of the roof; and B is a 2in. bath waste going direct to the soil pipe. Of

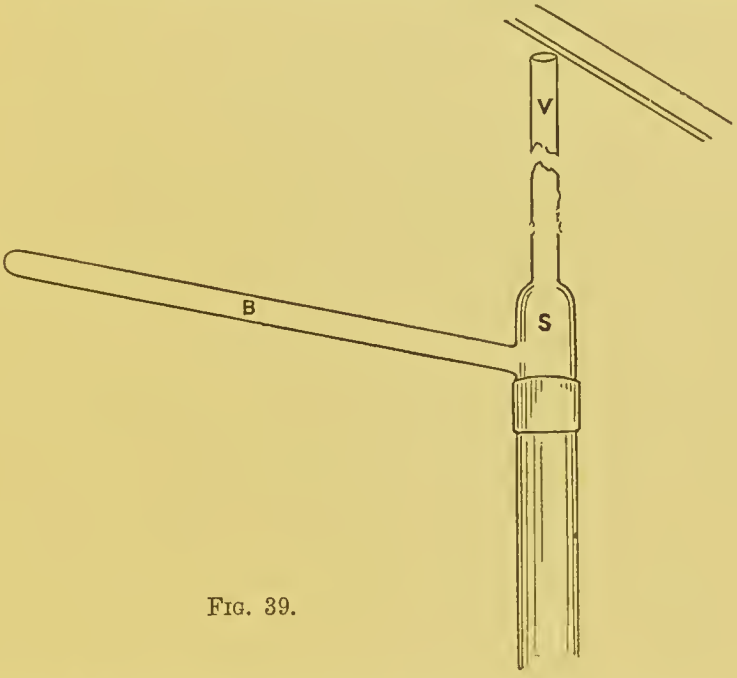


Fig. 39.

course, the bath waste pipe acted as a supplemental ventilator, ventilating the soil pipe into the bathroom.

Fig. 40 shows in section a bath and closet situated in a small outbuilding erected as a "lean-to" in the rear of a dwelling-

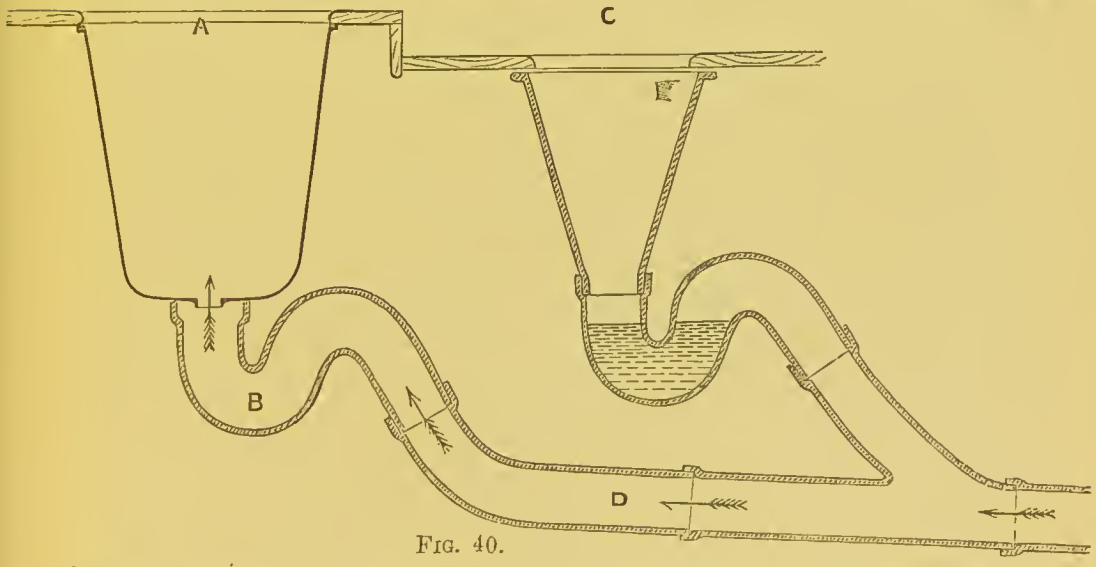


Fig. 40.

house. There was no other bath or closet in the house, and complaint was made of a very great effluvium nuisance in the outbuilding. The nuisance was verified, and its cause was soon apparent. I found the bath full of lumber, and the taps

designed for the hot and cold supply twisted and immovable. The tenant said the bath had never been used. Of course, the 4in. earthenware pipe trap beneath was dry; and although the closet trap was acting, there was nothing to prevent the drain gases and effluvia having access to the room. A represents the bath, B the trap to the same, C the closet, and D the drain. In designing the house it was a mistake to put the bath in an outhouse, access to which could only be obtained by crossing a yard. Such a bath would almost certainly be neglected. However, it would have been quite easy to have made the bath waste deliver on the gully in the yard, and then, whether the bath were used or not, no nuisance could have arisen.

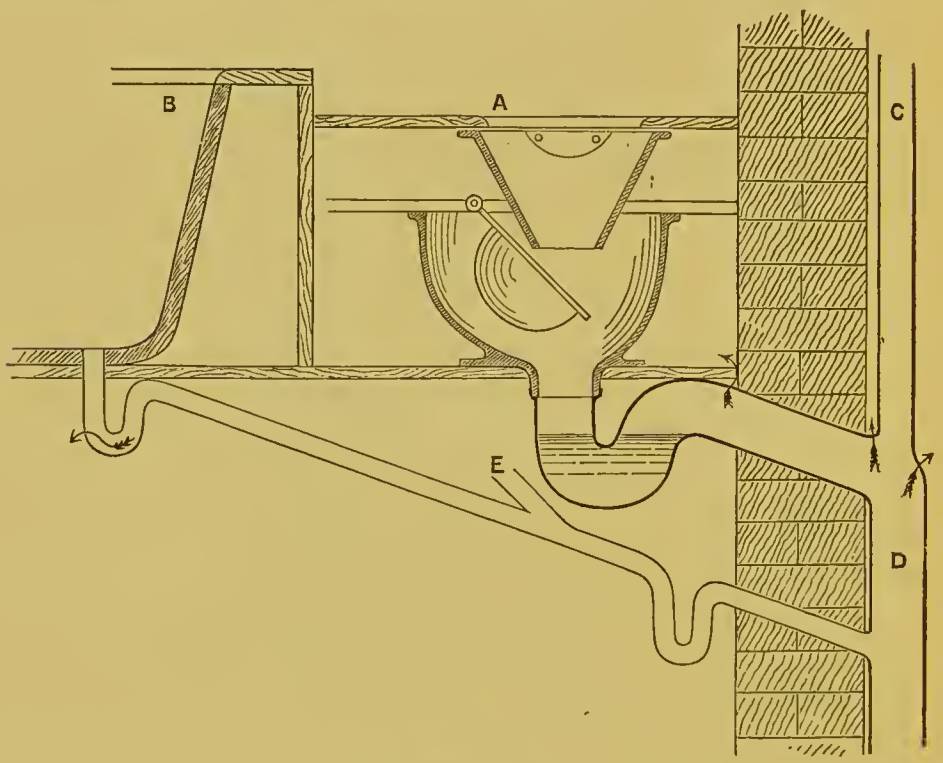


Fig. 41.

Fig. 41 shows the cause of an effluvium nuisance, which was most manifest near the bath. It was found that the trap under the bath was leaky, and an ineffectual attempt had been made te repair it with canvas, while the trap on the bath waste, next the wall, appeared to have been syphoned. A is the closet, B the bath, D a 4in. soil pipe, C is a 2½in. rain spout, made to act as a ventilator for the soil pipe, and E is a waste pipe from a urinal. As there was no trap between the sewer and the soil pipe, and the connections of the closet trap and soil pipe, and rain spout and soil pipe, were imperfect, sewer gas could escape into the bath and urinal, and at the points indicated by the

arrows in the illustration. That sewer gas actually did find its way into this house there is little doubt. A child died there, the cause of death being returned as "ulcerative pharyngitis;" and other inmates (mother and children) suffered from sore throats. Instead of complaining of the bad smell, attempts were made to smother it with carbolic powder, &c., and it was not till the death of the child that the attention of the sanitary authorities was directed to the house.

Fig. 42 represents a housemaid's sink, row of hand basins, and a bath, with waste pipes and overflow pipes discharging

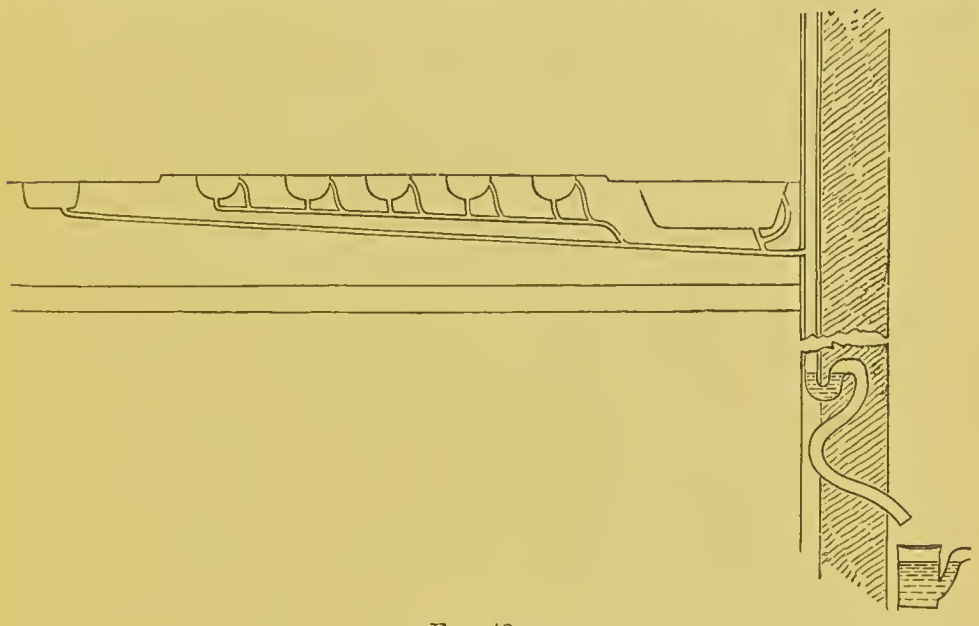
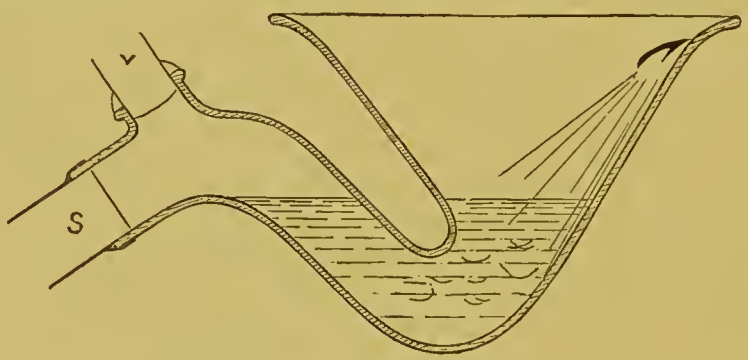


Fig. 42.

into a 2½in. pipe in a chase in the wall. There were three storeys, each provided with a similar range, all draining into the same 2½in. pipe, which was ventilated by being continued through the roof. As, however, this pipe was provided at the foot with a trap (imbedded in the wall), there was no passage of air through it. The consequence of this defective arrangement was that when the ranges on the upper and middle storeys were used, foul air was forced through the untrapped waste and overflow pipes in the lower storey; and when the range in the upper storey only was used, foul air from the untrapped waste and overflow pipes was perceived in the middle and lower storeys.

V.—WATERCLOSET FITTINGS.

WATERCLOSETS and their fittings should be of the simplest description practicable. All pan-closets having a so-called "container" interposed between the basin and the trap are objectionable. The container and pan which it contains soon become foul, and the only way of efficiently cleansing them is by taking them out and heating them sufficiently to burn off all impurities. Valve-closets are far cleanlier than pan-closets, and always to be preferred. However, on the principle that the simpler the apparatus the better, there is much to be said in favour of a basin immediately connected with, and, as it were, forming part of, a S trap. It would be out of place here to recommend a particular maker's apparatus, and indeed there must be many factories where basins and traps such as I have indicated can be procured; but lest there be any doubt as to the form of closet I refer to I insert a section in outline. S is



the soil pipe, to which the trap is connected, and V is a ventilating pipe to deliver into the soil pipe ventilator.

When the basin, trap, &c., are boxed in with wood a lead tray should be laid down on the floor, and drained externally; but the boxing-in is itself objectionable, and uncleanly.

It is scarcely necessary to point out that it is not desirable to have a watercloset immediately over a cistern, or any place in which water for domestic purposes is drawn.

The more obvious requirements may be summed up as follows:—

1. That the whole apparatus used should be of good quality, jointed and fitted in a workmanlike manner.

2. That every closet should be flushed with a separate service cistern, delivering a sufficient flush rapidly.

3. That every closet situated in a house should be against an external wall, and deliver into a ventilated soil pipe, or ventilated drain, external to the house, and that the short pipe leading from the closet trap should be ventilated.

4. That every closet, and the whole of the fittings in connection therewith, should be readily accessible, and in particular that the trap should admit of being thoroughly cleansed, and be as far as practicable self-cleansing.

The examples submitted show how the most necessary requirements are disregarded.

As a first contribution under this heading, I give particulars of a curiously-planned service to a closet. Complaint was received from the tenant of an eight-roomed house in a terrace of an effluvium nuisance, chiefly noticed in the basement. The nuisance, on an examination of the premises, was traced to a portion of the ceiling in the basement, where the water pipe, after being branched to the sink, disappeared. A rough hole had been knocked in a 4in. earthenware soil pipe, and through this the lead pipe had been passed. It was carried up inside the soil pipe through two floors, and reappeared, piercing the top of the lead trap beneath the closet basin, which it then served.

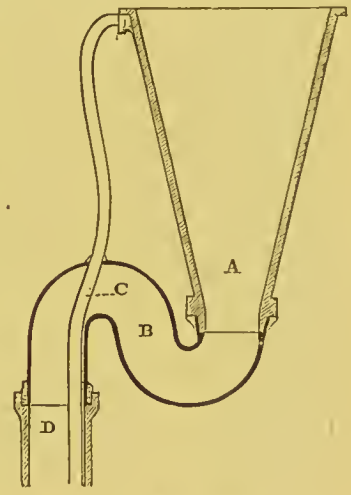


Fig. 43.

Fig. 43 shows the arrangement. A represents the basin, B the lead trap, C the lead service pipe, and D the earthenware soil pipe. Where the service pipe came through the trap it was carefully soldered round, but where it entered the earthenware soil pipe, about 14ft. lower down, the stopping was of mortar, and imperfect, allowing the passage of foul air from the soil pipe into the basement. Thus was the nuisance caused which led to this extraordinary service being brought under the attention of the sanitary authority. The closet and soil pipe, which were against the party wall, 13ft. back from the front of the house, were removed, and the nuisance has therefore been effectually abated. I nnd the terrace in which this house is situated was built in 1871, and each house has a watercloset against an external wall, and fitted with a separate service cistern. A previous tenant of the house complained of had a bedridden relation, for whom he desired to provide a closet in the upper storey, and employed a local plumber with the results shown.

A correspondent sends me a sketch and description of an arrangement for disposing of slop water and flushing a closet in

a villa residence he inspected. It seems strange how a plan so obviously objectionable came to be adopted. The sketch is reproduced in Fig. 44. A is a cistern serving the closet beneath, the cistern being supplied with rain water through a pipe not shown. B is a housemaid's sink, and C the waste pipe from the same, discharging into the cistern A. D is the pipe flushing the closet. An effluvium nuisance having arisen each time the closet was flushed, the apparatus was carefully examined, and it was then discovered that the closet was flushed, not with rain water only, as was supposed, but also with the slops daily thrown down the housemaid's sink.

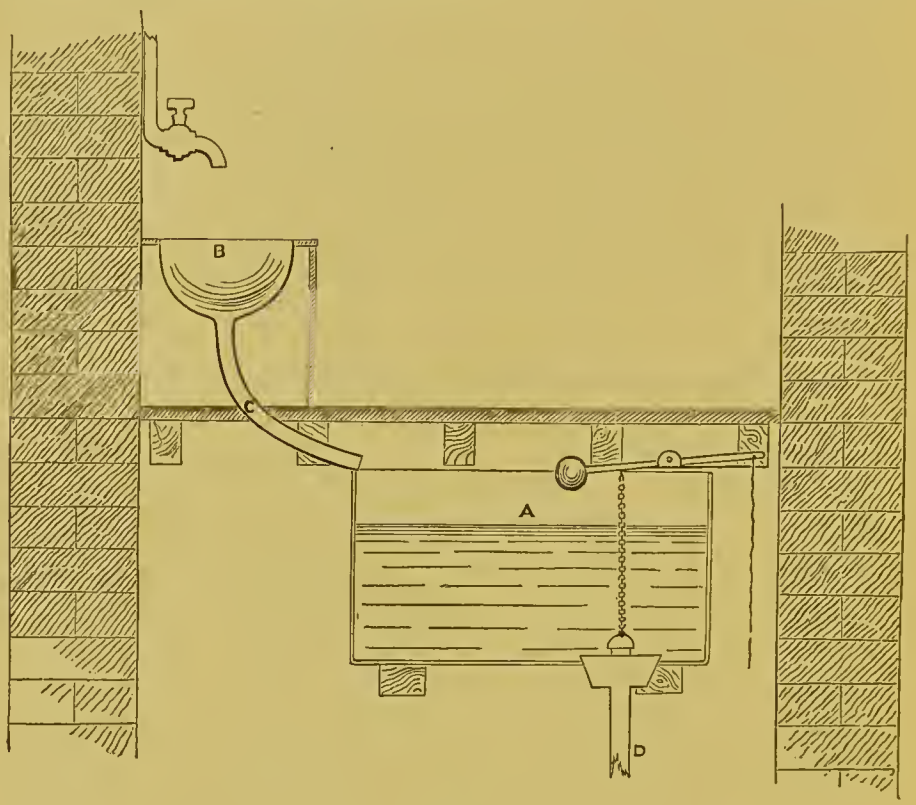


Fig. 44.

Fig. 45 shows how some midden privies were converted into dry ashpits and waterclosets. A hole was made in the wall A, just under the rafters B, large enough to admit the end of the cistern C. The cistern in each case was of light galvanised iron, 15in. by 6in., and 12in. deep. The whole of the cistern, excepting the small portion resting on the wall, is actually in the ashpit. Cisterns in such a situation are exceptionally liable to get foul, and are almost inaccessible. No overflow is provided, and the supply pipe D passes up a corner of the midden, through the ashes and refuse. The drain from the closet is ventilated (or, to be more correct, an exit for the drain air is provided) by means

of 4in. earthenware pipes E, built up the end wall of the midden-stead, and delivering effluvia at a low level.

Fig. 46 represents an old pan closet as seen from the front. It was the only closet in a suburban villa rented at about £40. A nuisance was complained of, and on removing the wood which concealed the basin and container, both were found to be in a most filthy state, as well as the parts beneath. There was no

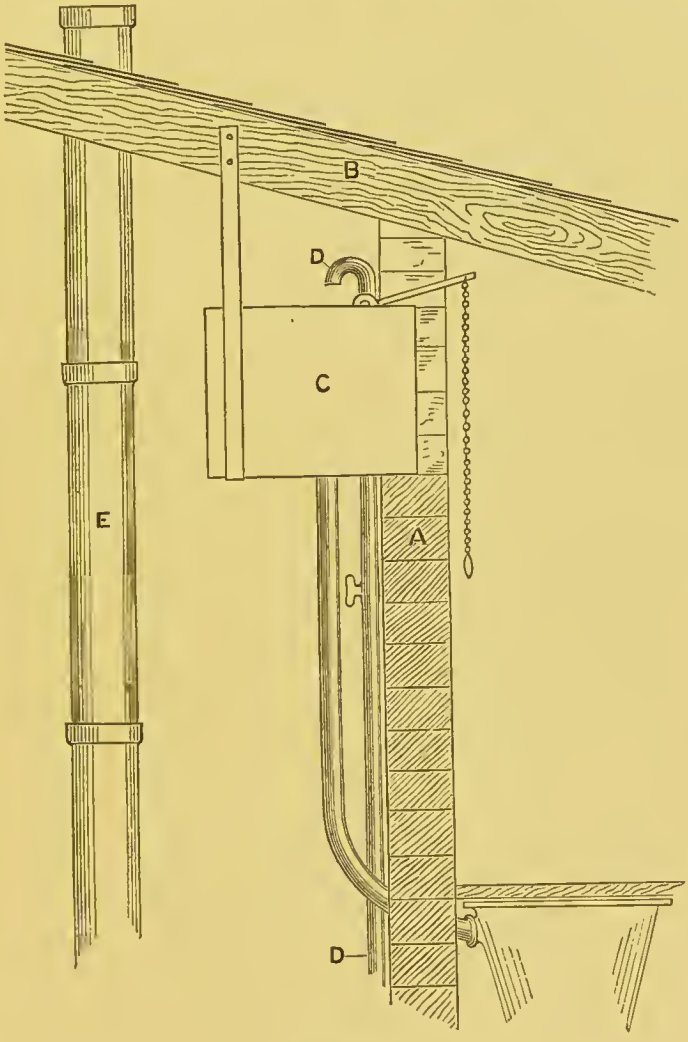


Fig. 45.

housemaid's sink on the premises, and it was obvious that when the housemaid had thrown the slops into the basin they had frequently run over. As no lead tray, ordinarily called a "safe," was provided, the slops running over saturated the woodwork all round, the result being a most abominable nuisance. It is noticeable that the sanitary fittings of this house had been in other respects well planned. The rooms were specially ventilated —the waste pipes, overflow pipes, and rain spouts were discon-

nected, &c.—but as unfortunately tho local byelaws do not require safes to be placed beneath closets, a *saving* had been effected in this respect. This is not the only nuisance I have found due to this cause, but certainly the worst. In the cut, A is the seat, B the basin, and C the container.

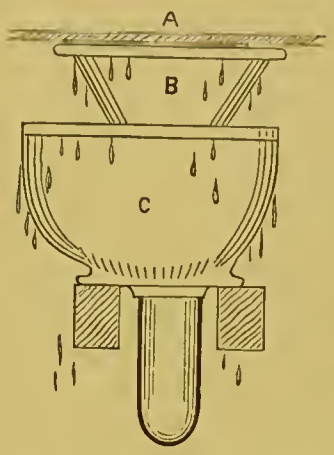


Fig. 46.

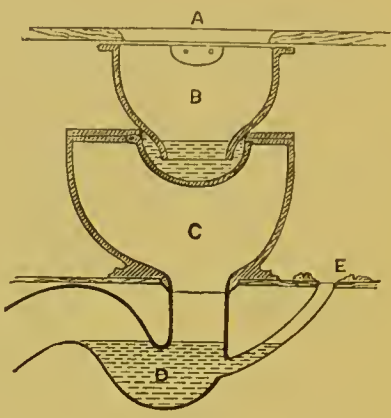


Fig. 47.

Fig. 47 shows a closet in which the lead tray just referred to was provided, but a nuisance had been caused through draining the tray into the closet trap. The surface of the safe around the drain was filthy, showing that foul matter had been pumped up from the trap each time the closet had been used. A is the

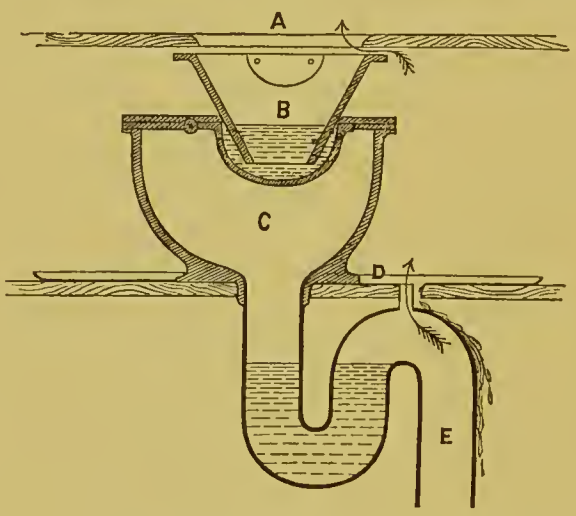


Fig. 48.

seat, B the basin, C the container, D the closet trap, and E the drain from the safe.

Fig. 48 represents a much more serious blunder on the part of a local plumber. The safe or tray to catch any foul water, &c., overflowing from the basin had been fixed, but in order to drain it a 1in. pipe from the safe had been carried into the soil pipe. The

soldering of the top of this short pipe to the safe had given way, and it was found that the safe had been draining on the outside of the soil pipe. However, the foul air and gases in the soil pipe had ready access to the house, as shown by the arrows in the illustration. A is the closet seat, B the basin, C the container, D the safe, and E the soil pipe. The house in this instance was a very old one (rent about £40), and the closet fittings were old and worn.

Fig. 49 shows in section a curious fixture, which, I think, cannot be very common. I can only describe it as a privy got up to look like a watercloset. A long earthenware basin B was screwed up to the underpart of the seat A, and the surface of the earthenware had become exceedingly foul. The quaint name was given it—"a dry watercloset."

Fig. 50 represents a watercloset without water service, which was fitted in the yard of a cottage situated in a back court. On seeing there was no arrangement for flushing, I was surprised

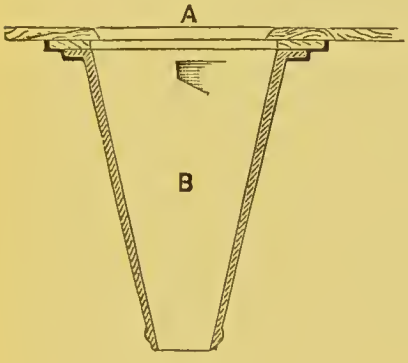


Fig. 49.

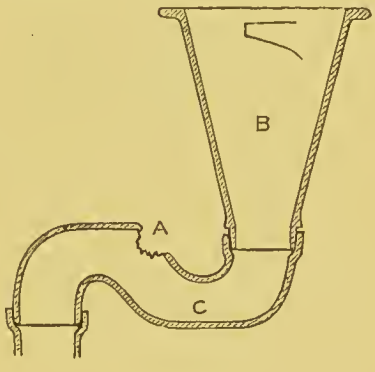


Fig. 50.

the basin was not full, and I directed a further inspection, when it was found that a hole had been made in the top of the earthenware trap, which was jointed to the basin. I made particular inquiries as to this hole, and was told that "the man that fettled the thing, for fear it would get choked," made the hole—in other words, the hole was made that the contents of the pipe beyond might be pushed on with a stick, or otherwise. In the woodcut, B is the basin, C the earthenware trap, and A the hole referred to. As the hole was made on the drain side of the trap, it established a direct communication between the drain and the closet, which would have remained even if the trap had been kept charged with water.

Fig. 51, sent me by a correspondent, represents a closet basin trapped into a galvanised iron bucket. The contents, of course, overflowed and found their way into the open drain shown to the left in the sketch. Next to this abominable closet was the kitchen, and the foul air and foul smells went through the joints

of a wall, almost destitute of mortar, and between the planks of the floor into the kitchen. The man who fitted this closet seems to have aimed at preventing the sewer gases from coming up the basin; but as the drain was untrapped they, of course, came

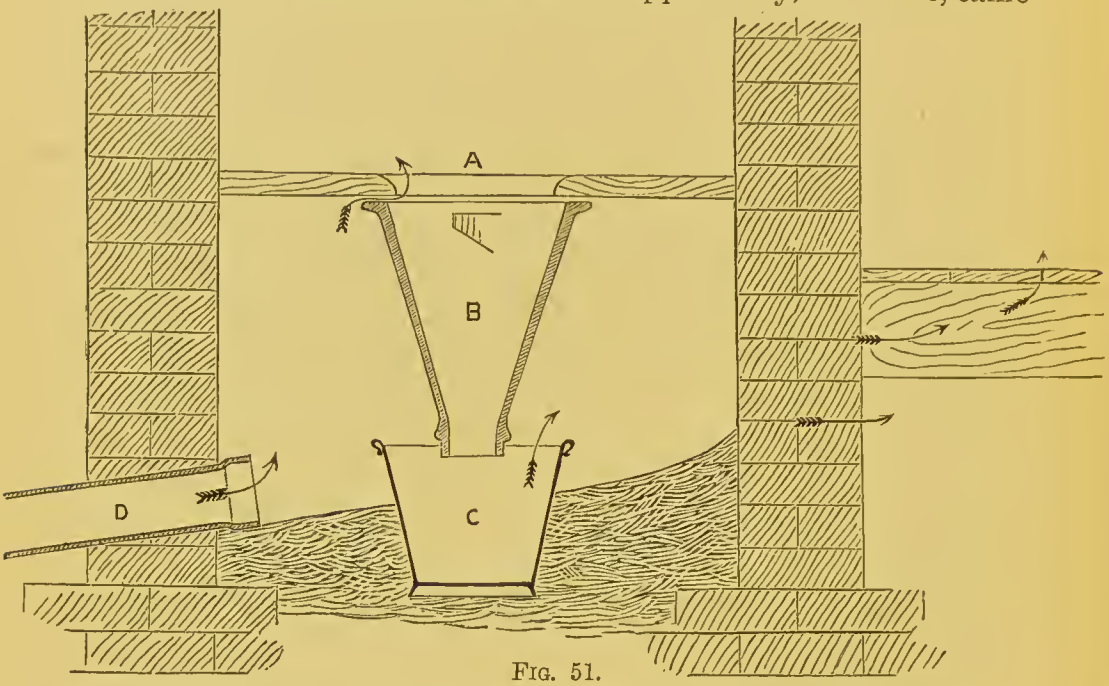


Fig. 51.

up without check external to the basin. The result of his contrivance was that he produced even a worse nuisance than if he had simply jointed the untrapped drain to the basin. A is the seat, B the basin, C the bucket, and D the drain.

Fig. 52 shows an ordinary "pan" closet, which was fixed without a pan. The tenant had been in the house upwards of

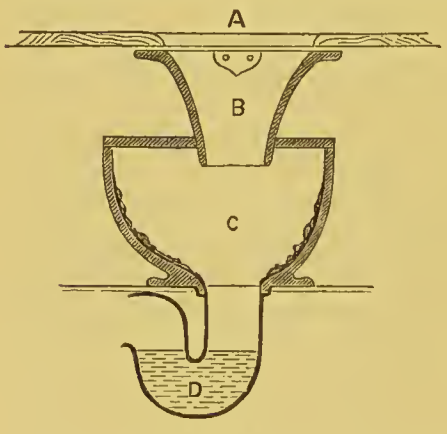


Fig. 52.

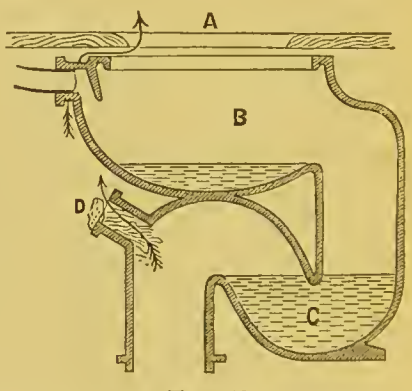


Fig. 53.

a year, and told me the closet was as I found it from the first. If the pan had merely become broken off at the hinge it would have fallen, and probably caused an obstruction; if from any defect in the apparatus the pan could not recover its proper

position after flushing, it would have been hanging empty in the container. As it was, it was simply missing, and the plumber must have fixed the apparatus as I found it. The whole of the inner surface of the container, which was, of course, foul, was exposed, and a cause of more or less effluvium nuisance. A is the seat, B the basin, C the container, and D the trap.

Fig. 53 indicates a danger from certain new forms of closets which had not occurred to me till the defect shown in the cut came under my attention. Many of these closets have an opening placed behind the trap for connecting a ventilator. The "National," the closet shown in section in the illustration, is thus contrived. It appears to be a good closet, and, if properly fixed and kept clean, is free from nuisance. However, very great nuisance was experienced from the particular closet I refer to, and, on uncovering it, it was found that the man who fixed the apparatus, instead of attaching a ventilator, filled up the hole where the ventilator should have been connected with *paper*, and covered this over at the top with putty. In course of time the putty loosened, and then the foul air from the soil pipe had ready access into the house. Of course, this foul air was rendered more foul by passing through a plug of paper saturated with the filth of years. A is the seat, B the basin, C the trap, and D the "stopped" vent hole.

Fig. 54, with a description of the defect represented therein, was sent me by a correspondent. Complaint was received from a large boarding school, and my correspondent made a careful examination of the sanitary arrangements generally. On applying the smoke test it was found that smoke issued from the basin of the

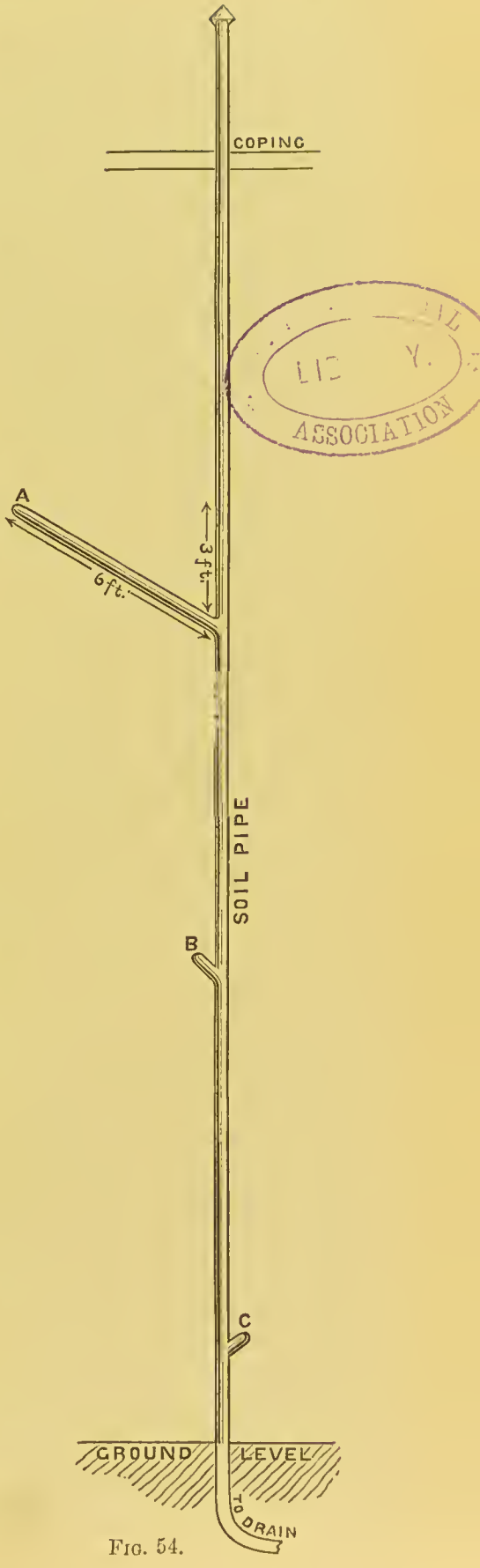


Fig. 54.

watereloset at the top of the house, owing to the seal of the trap of this watereloset having been broken. How this had happened was not easy to discover. The trap was filled, and then the closet was flushed in the usual way. It was a powerful flush, but the water seal of the trap was only reduced from $1\frac{3}{4}$in. to $1\frac{1}{2}$in. Further inquiry, however, elicited the fact that the house slops (including water from sponge baths, &c.), amounting to about twelve pailfuls, were every morning emptied down the closet referred to, one pailful after another in quick succession. By way of experiment a pail of water was discharged into the basin of the closet quickly, and the normal depth of water in the trap was found to be redueed three-quarters of an inch. Another pail was discharged in like manner, and the depth of water in the trap was reduced half an inch more. A

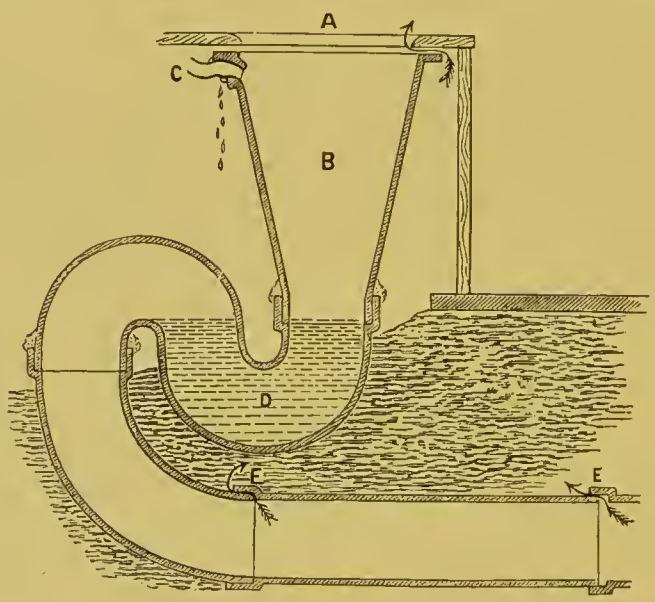


Fig. 55.

third pailful was discharged, and this time the water seal was completely broken, as was proved by a lighted candle held in the lower part of the basin of the watercloset being almost blown out by the air entering from the soil pipe. The action of pailfuls of water poured down this trap was thus demonstrated. Doubtless a similar action had been produced daily for some considerable time. The soil pipe into which this closet and two others discharged was continued above the roof, in its full diameter, for ventilation, as indicated in the cut. The branches from the three elosets connected are indicated by the letters A, B, and C respeetively. The closet joined to branch A has an ordinary cottage basin and P trap, both of glazed earthenware, and is the particular closet experimented upon. The closets eonneeted to branches B and C are valve closets with lead D

traps beneath. No attempt had been made to ventilate the traps of either of the closets; and as the branch at A was six feet in length, and had a fall of three feet (as shown in the figure), and the P trap, which was of circular section, was thus a syphon trap, it is easy to understand how syphonage took place. It is worth noting that the discharge of pailfuls of water down the top closet had little, if any, effect upon the traps of waterclosets beneath, due probably to the class of traps here provided and the ventilation of the soil pipe. My correspondent remarks that it is no uncommon thing, in his experience, to find the water seal of a trap broken in the servants' (outdoor) closet, as the result of being flushed by means of a pail. This is a matter which is apt to be overlooked.

Fig. 55 shows in section a closet in the basement of a large semi-detached house in the suburbs. The closet was situated

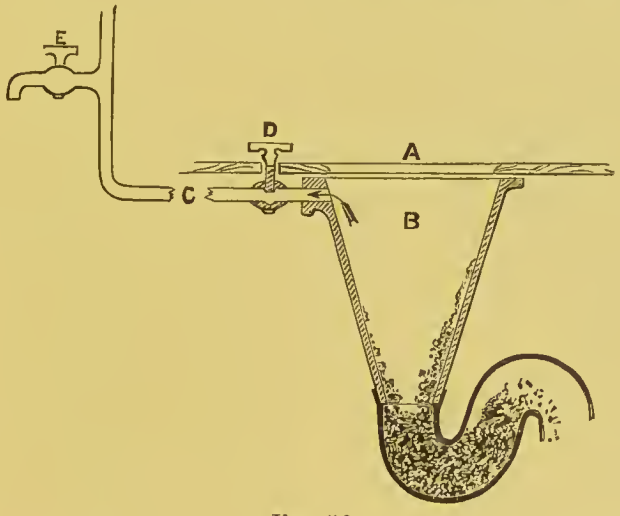


Fig. 56.

against an outer wall, but the drain from it and all the other drains were laid under the house and under the adjoining house. The house had been built a long time, but the nuisance had only lately been specially noticed. On exposing the basin it was found to be connected to a 6in. S bend of glazed earthenware pipe, and this was connected to the pipe drain as shown. The basin was jointed to the S pipe thoroughly well with cement, and so was the S pipe to the pipe next it, and these were the only two joints which could be seen, the rest being underground. On exposing them they were all found to be clay joints, and some very imperfect. A is the seat, B the basin, D the S trap. C is the water service connection, which was leaking, and the water from this leak had saturated the ground beneath, and appeared to have washed out some of the clay from the joints EE, which were quite open.

Fig. 56 is a section of a eloset direetly served from the main. A is the soat, B the basin, C the serviee pipe, D the serew-down tap on this pipe, and E the tap over the sink-stone, served from the same pipe. This arrangement was very common some years back, and though I have been long doing my utmost to get owners to provide closets with separate serviee cisterns, examples of the defect are brought to notiee every month. When a single watereloset is flushed direct from the main the risk of fouling the town water (it may be with specifie germs) is eonsiderable, while

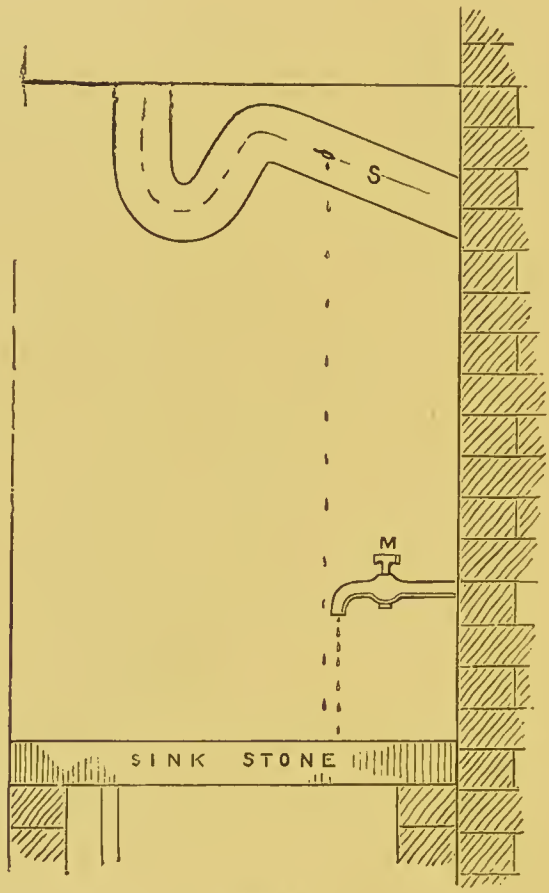


Fig. 57.

the risk of fouling the drinking water on the same premises is at any time probable. I have seen elosets served from the main choked and nearly full, and at a time, too, when the serviee was not eonstant.

Fig. 57 is, I consider, one of the most interesting euts in this series, and I desire to draw speeial attention to it. I reeeived notiee of a ease of typhoid fever in a very old house in a poor neighbourhood. The patient was forthwith removed to the fever hospital, and the usual report as to the state of the premises was submitted to me. From the latter I

gathered that the house was dirty, and that there was a water-closet built out from the back wall, a separate service cistern for the same, and a pipe from the main for drinking and domestic purposes. Not satisfied with this report, I examined the premises myself. I found the closet was entered from a small landing on the stairs, between the ground floor and first floor. On looking to see what was under this (on the ground floor), I was surprised to find a sink-stone, and a tap from the main. Immediately over the sink-stone was the lead trap from the closet and a transverse portion of soil pipe connected therewith, which was carried through the back wall into the house. In the soil pipe close to the trap was a corroded hole, the position of this being shown in the cut. Through this hole foul gases must often have been discharged, and foul liquids from the closet must often have overflowed. Indeed, here were all the conditions present which one would expect to find resulting in an outbreak of typhoid fever. What in all probability happened is that drinking water drawn from the tap was polluted with excremental liquid dropping into it, and that water thus polluted was actually drunk. The illustration indicates how easily a jug of water drawn from the main tap M might be polluted by foul liquid running from the hole in the soil pipe S.

VI.—VENTILATING SOIL PIPES.

IT has been already stated that the soil pipe should always be external to the house. To ventilate it efficiently a pipe of the same size as the soil pipe should be taken up and terminated at least 2ft. above the roof eaves, care being taken that the end is not near any dormer window or opening in the roof. The ventilator should be connected to the soil pipe at the point where it emerges from the house. It should be securely fixed, and all the joints should be perfect. Sometimes a round plate of metal is fastened a few inches above the ventilator, sometimes the end is turned downwards, and sometimes the end is furnished with a revolving top or other apparatus, to create an upward draught. However, there is no objection to leaving the end free. In order that a ventilator may act there must be a fresh-air inlet not far from the base of the soil pipe, but as this inlet occasionally serves as an outlet, it should not be near enough to the house to create a nuisance.

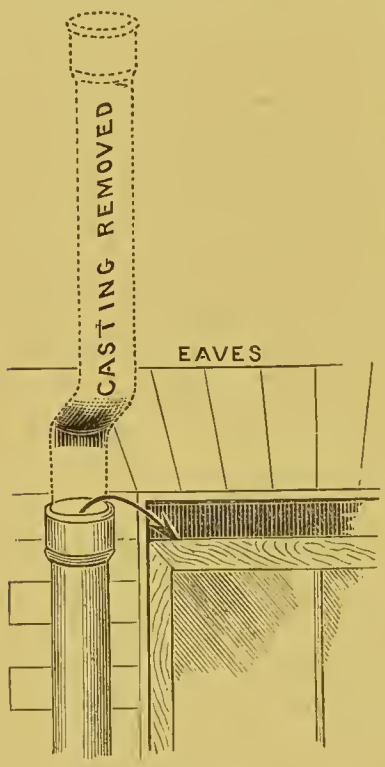


FIG. 58.

That many mistakes may be made over such a plain job as ventilating a soil pipe the examples of defects under this head will show.

My first example is not an instance of blundering but of deliberate wrongdoing. The defects I call attention to were simply the result of an impudent attempt to evade the law and get a certificate dishonestly.

My attention was called to four houses where the soil pipe ventilators terminated close to back windows. In three cases the ends were on a level with the tops of the windows, and in one case a foot above the top. As the requirement with respect to soil-pipe ventilators is that they shall be carried up not less than 2ft. above the roof eaves, and the houses were quite new, special inquiries were instituted. Under the local Act, passed in 1881, it is "not lawful to let or occupy as a dwelling-house any building, not so used before the commencement of the Act, until

sueh building has been eertified by the surveyor, or other offieer appointed for the purpose, to be as to drainage, supply of water for domestic purposes, and in every other respeet fit for human habitation, and eonstrueted and eompleted in eonformity with the provisions of the Act and the loeal bye-laws." It transpired that these four houses were submitted to examination, the soil pipe ventilators then terminating as required 2ft. above the roof eaves, and were duly certified fit for human habitation. How-

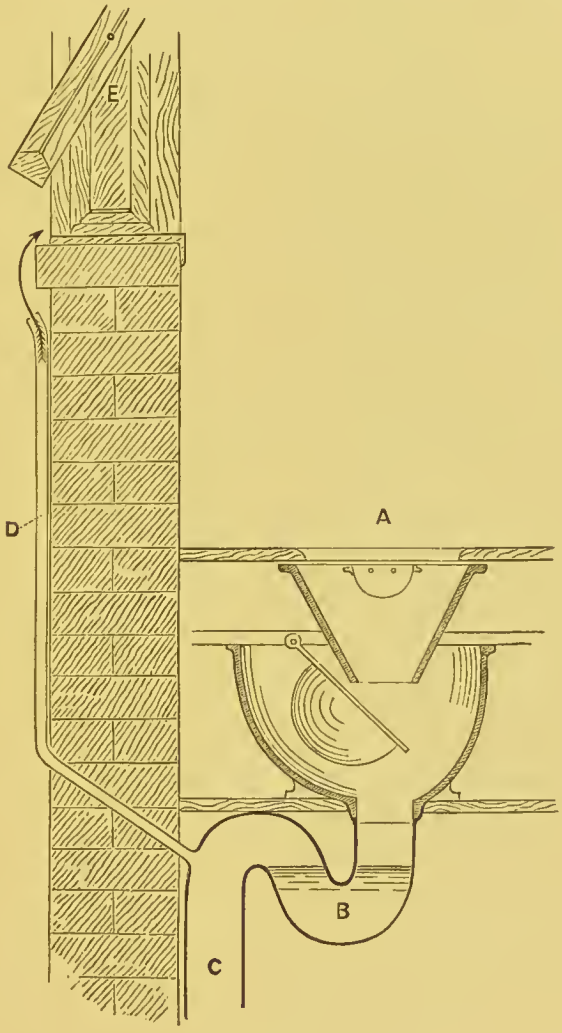


Fig. 59.

ever, shortly afterwards other houses approaehed eompletion, and iron eastings neeessary to carry the ventilators 2ft. above the roof eaves not being ready to hand, those belonging to the four houses already certified were removed, and made to do duty in obtaining a eertificate for other houses. When the houses thus robbed were visited, three were oeeupied, and in eaeh of these three the window next the soil pipe end was open for two or

three inches at the top. The accompanying illustration (Fig. 58) explains itself.

Fig. 59 represents an old pan closet which, although placed next an external wall, delivers into a soil pipe carried down inside the house. The closet A delivers into a lead syphon trap B, which is continuous with the soil pipe C. The soil pipe is connected with an earthenware pipe drain running under the

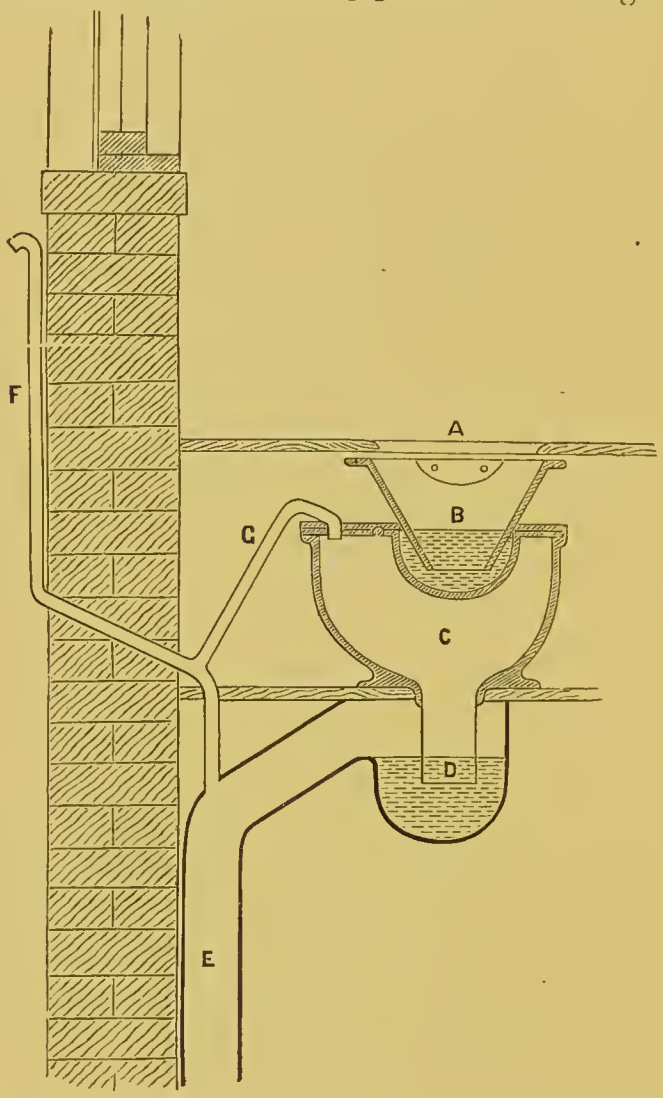


Fig. 60.

house. Neither the closet nor the position of the soil pipe and drain can be approved of, but the special defect to which attention is directed is the device for ventilating the soil pipe. A 1in. lead pipe D is carried from the soil pipe through the wall, and made to terminate just below the closet window E. Of course a pipe of this capacity is a very inefficient ventilator, and much of the foul air it does afford escape for is likely to

be drawn into the closet whenever the swing window happens to be open. In the figure the ventilator is represented as a ¾in. instead of a 1in. pipe.

Fig. 60 explains itself. It gives a section of the closet fittings found in a large ecclesiastical residence, where what were alleged

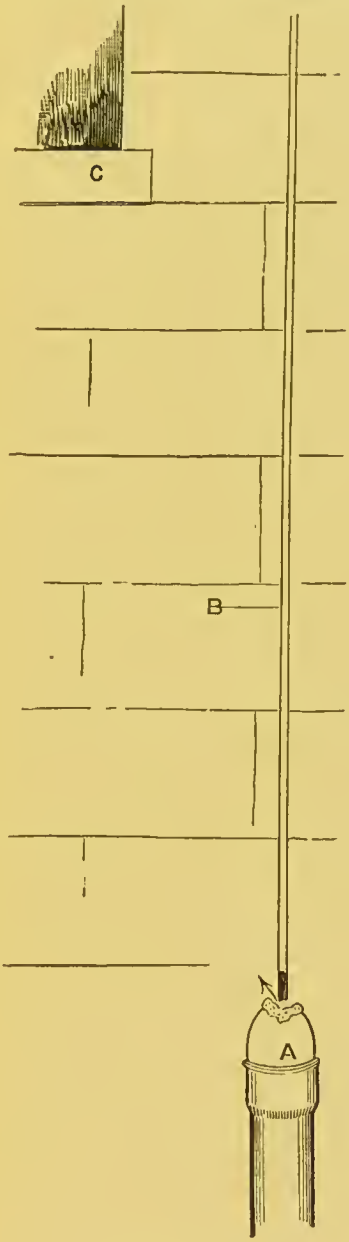


Fig. 61.

Fig. 62.

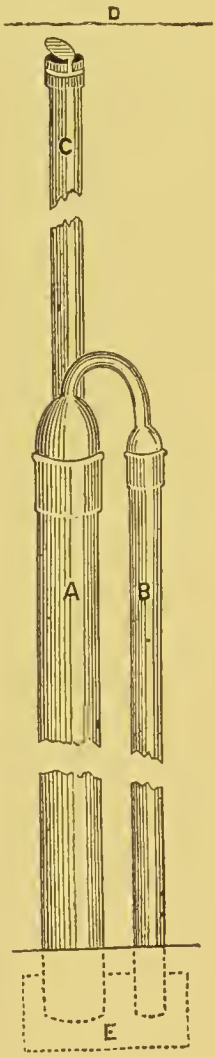


Fig. 63.

to be "modern sanitary improvements" had been carried out. A is the seat, B is the basin, C the container, D the D trap, E the soil pipe, F a ventilator for the soil pipe, and G a ventilator for the container. It will be seen that this soil pipe is inside the building, and ventilated by a 1in. lead pipe terminating under

a window, which, as noticed in the last example, is a very unsatisfactory arrangement. However, matters were made much worse by carrying a 1in. pipe from the container into the soil pipe ventilator. By this device the D trap is rendered useless, as whenever the pan falls the foul air and gases from the soil pipe have free access to the house. It may be added that trapping a closet with a D trap is objectionable, as the end of the pipe submerged sooner or later corrodes, and the trap ceases to be of any use.

Fig. 61 shows a "ventilator" to a soil pipe which I discovered at a large suburban house. It was put up with the approval of the local surveyor and medical officer. A 4in. lead soil pipe was brought through the wall and efficiently connected with an iron soil pipe. A large hole had then been made in the lead at the top, and a ½in. iron pipe connected to this hole with putty. The iron pipe was quite closed up at the lower end with rust, &c., and was just too short to meet the lead pipe. Through a large hole in the lead and putty, effluvia ascended to the window 5ft. above. A is the lead pipe, B the "ventilator," and C the window.

Fig. 62 illustrates a somewhat similar defect. S is a 4in. lead soil pipe at its exit from the house. Below it is connected with an iron pipe, and above a hole has been made, and 2½in. of 2in. lead pipe jointed thereto. Just 4½ yards to the left of this short "ventilator" is a window. It is probable that the work, as originally planned, included a 2in. ventilator to be taken above the roof eaves, some 8ft. above the short pipe V, and this ventilator, owing to carelessness or economy, was never fixed.

Fig. 63 shows how the soil pipe and bath waste in a large semi-detached house were brought down from an upper storey and ventilated. The 4in. iron soil pipe was ventilated with a 2in. iron pipe, terminating just under the roof eaves, and capped with a little metal top, as if purposely to direct any foul air emitted towards a window a few inches off. The 2in. iron bath waste came out by the side of the soil pipe, and was connected with it (for what purpose I know not) by a 1in. lead pipe, as shown. A is the soil pipe, B the bath waste, C the soil pipe ventilator, D the roof eaves, and E the chamber into which soil pipe and bath waste delivered, and through which the contents were transmitted to the 6in. pipe under the house. Taking a soil pipe and bath waste out separately, and afterwards connecting them together, above and below, seems an unusually ridiculous proceeding.

A correspondent has kindly drawn my attention to a soil pipe ventilator which is certainly noteworthy. Such an unworkmanlike contrivance I hope and believe is not common. (*Vide* Fig. 64, which is carefully drawn to scale.) W represents the window

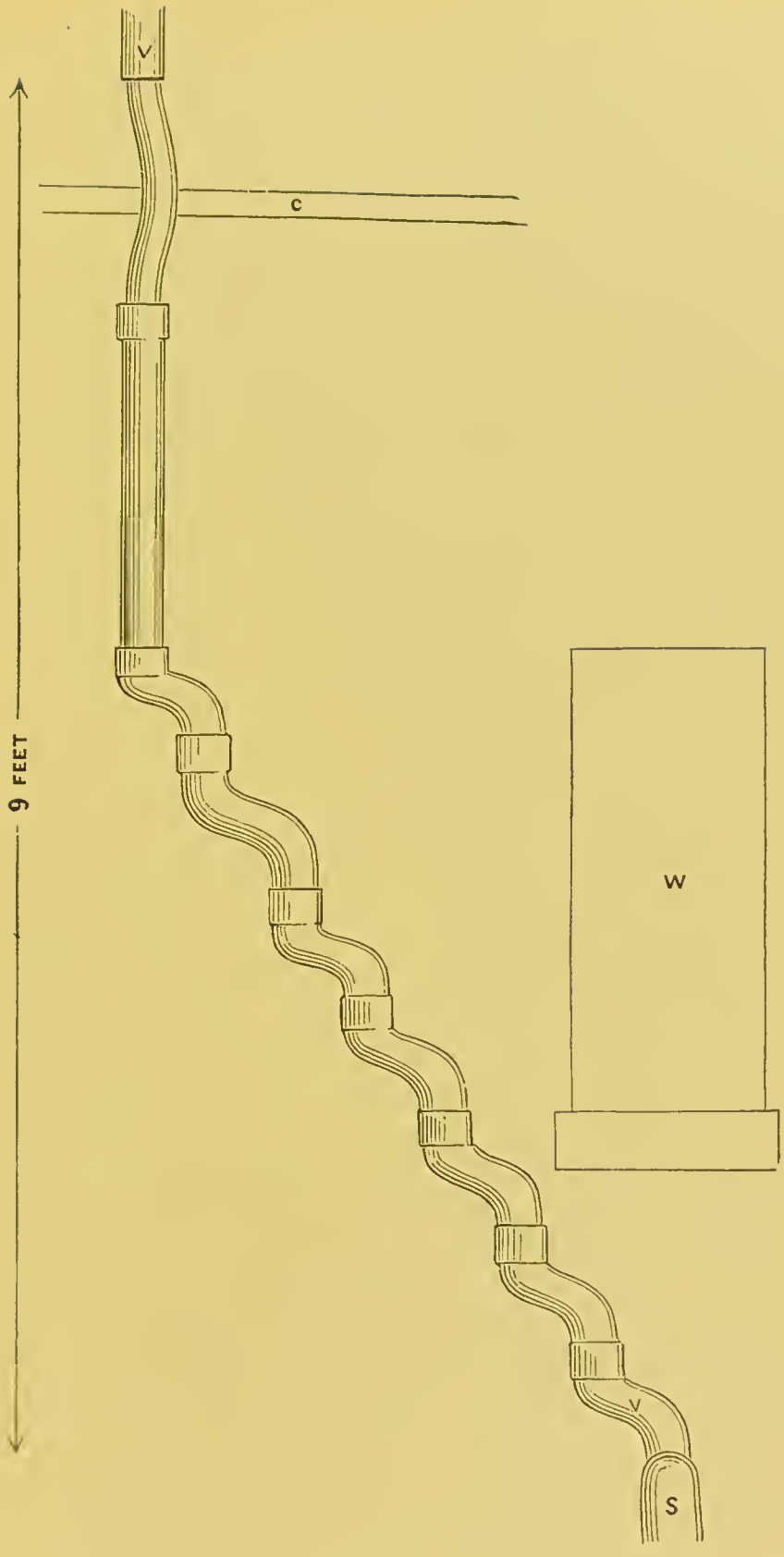


Fig 64.

of a closet, and S the lead soil pipe from same. Jointed to this was an iron pipe easting, whieh carried the ventilator up nine inches; and next to this eame a seeond, third, and fourth casting of the same size; and then three more eastings similar in shape and averaging the same length. Above this was 2¼ft. of iron pipe, then the rain gutter C had to be "jumped," and there was a further length of about 8ft. of iron pipe, the ventilator terminating a few inehes above the top of the gable. It will thus be seen that the ventilator VV, in aseending 9ft., had no less than ten joints. It is not likely that all these joints were tight in the first instance, and quite impossible that they would remain so after the expansions and contraetions of a few summers and winters. Two windows, one above the other, to the left,

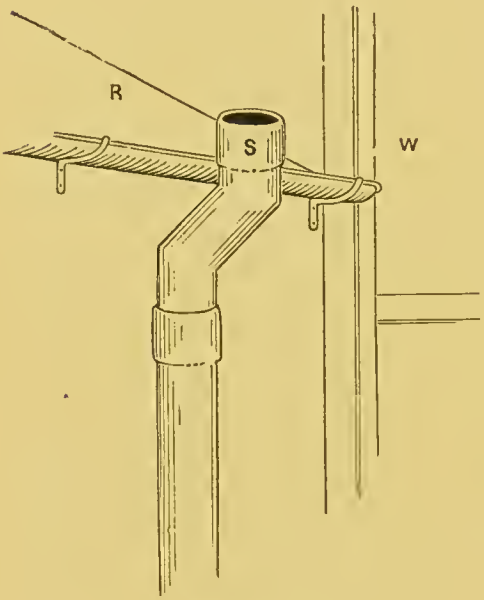


Fig. 65.

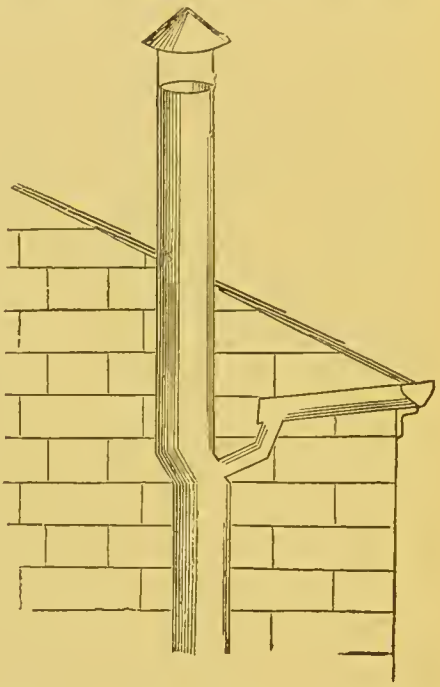


Fig. 66.

were in elose proximity to these joints. It is to be noted that while the soil pipe is 4in. in diameter the eurved castings are 3in. pipes, and above a smaller diameter pipe is used. My eorrespondent remarks that the plumber responsible for this work was probably uninformed on the subjeet of resistanee to air eurrents by frietion, and that he saerifieed effieieney to a taste for ornamental deviee and the desire to sell as mueh piping as possible.

Fig. 65 indieates yet another way in whieh soil pipes are deliberately ventilated into bedrooms. The defect was noticed in several newly-built houses forming one side of a main street. A portion of eaeh house projeets into the yard, and is one storey lower than the rest of the building. These portions eontain the

closets. The soil-pipe ventilators should, of course, have been taken up 2ft. or so above the eaves of the roofs of the main buildings. As it is, however, the ventilator has, in each instance, been carried just above the gutter of the lower roof, and terminates close to a bedroom window, as shown in the illustration. R is the lower roof, S the soil pipe ventilator, and W the window.

Fig. 66, from a correspondent, represents a soil-pipe ventilator into which the rain is conducted. The trapped bath waste and overflow, as well as the rain pipe, are connected with what is

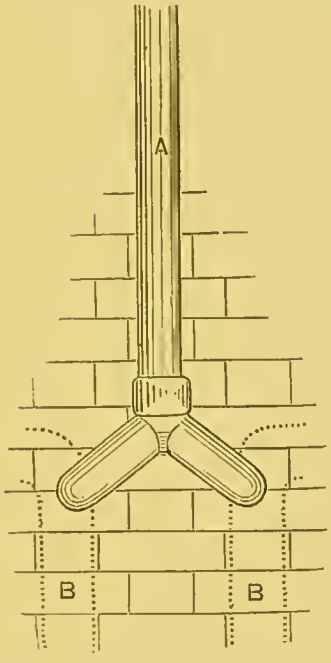


Fig. 67.

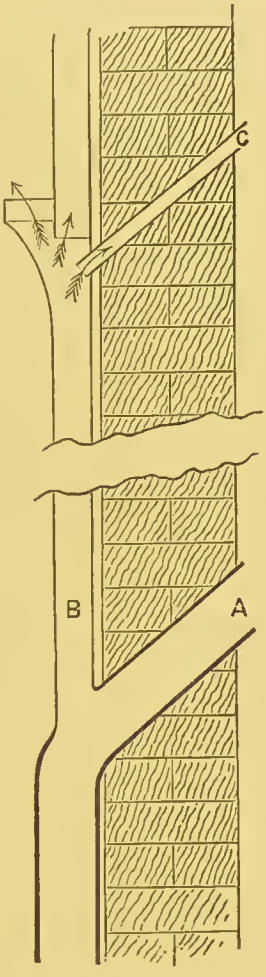


Fig. 68.

intended as a ventilator to the soil pipe; but as this is sealed at its base by the contents of a syphon trap, the soil pipe is really unventilated. A pipe such as this, remarks my correspondent, is expected to convey rain and waste water downwards and a current of air upwards, and this occasionally at one and the same time, the effects of the compression of the contained air below the points of discharge, and of syphoning and trapping water, not being apparently considered. Ventilators as described

are fitted to two new houses, and as a bye-law of the Local Sanitary Authority requires every house to be inspected before being inhabited, either the above construction passes muster or there is room for improvement in the manner of inspection.

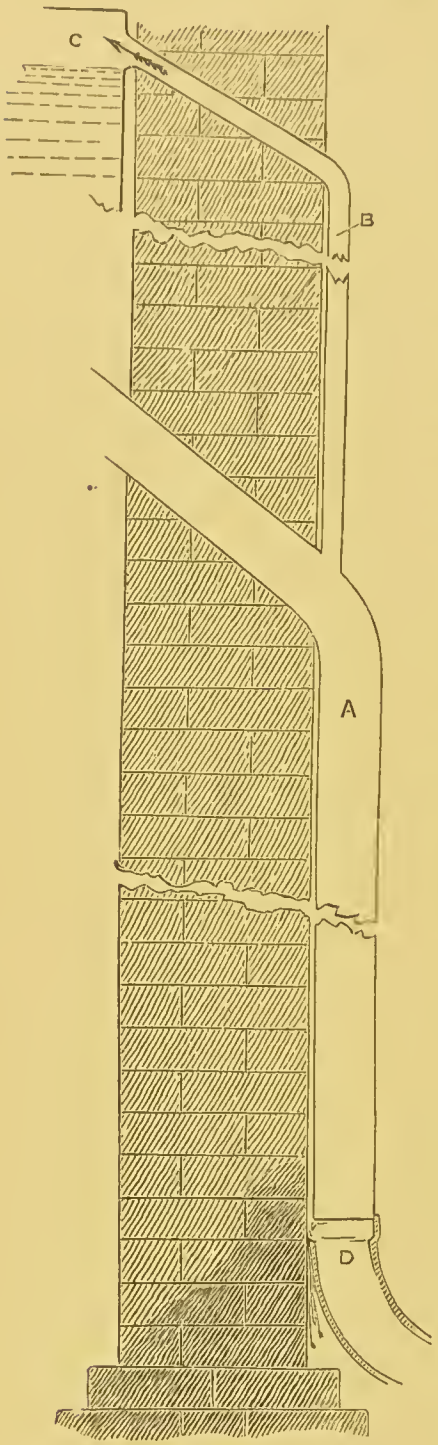


Fig. 69.

Fig. 67 represents two soil pipes built into the wall, and ventilated in a novel way. A pair of semi-detached villas had closets in the front, on the first floors over the lobbies. The soil pipes coming very near the surface of the wall on the inside were covered by about an inch of plaster; and in one villa the staining of this plaster and an effluvium nuisance gave indications of a leak. On calling at the villas with reference to this nuisance, the first thing noticed was the iron ventilator as shown which was connected with both soil pipes. It was not ill-fitted, and was carried up 9in. above the roof eaves. If a stoppage had occurred in either of the soil pipes, the contents would probably have overflowed into the common ventilator and choked it. A indicates the ventilator, B and B the two soil pipes.

Fig. 68 represents an ingenious device for ventilating a soil pipe into a bedroom. Offensive smells in the bedroom were noticed and complained of. On inspection it was found that there was an open cistern in the bedroom, and that the overflow pipe from this was carried into the rain spout, which was made to act as a soil-pipe ventilator. A is a 4in. soil pipe taken out direct from a closet, B is a 2½in. rain spout connected therewith to ventilate the soil pipe, and C is the overflow pipe from the cistern. The result was that

part of the foul air from the soil pipe was conveyed up the overflow pipe into the bedroom, part ascended the upper portion of the rain spout to the roof gutter, where a portion got in under the slates, and part was delivered externally to be drawn in at contiguous windows when open.

A correspondent sends me a sketch and description of a defect which he recently saw in an old house. (*Vide* Fig. 69.) Here is an unventilated soil pipe taken outside directly it leaves the watercloset, and as there is no proper connection between the soil pipe and house drain, filth is allowed to escape into the

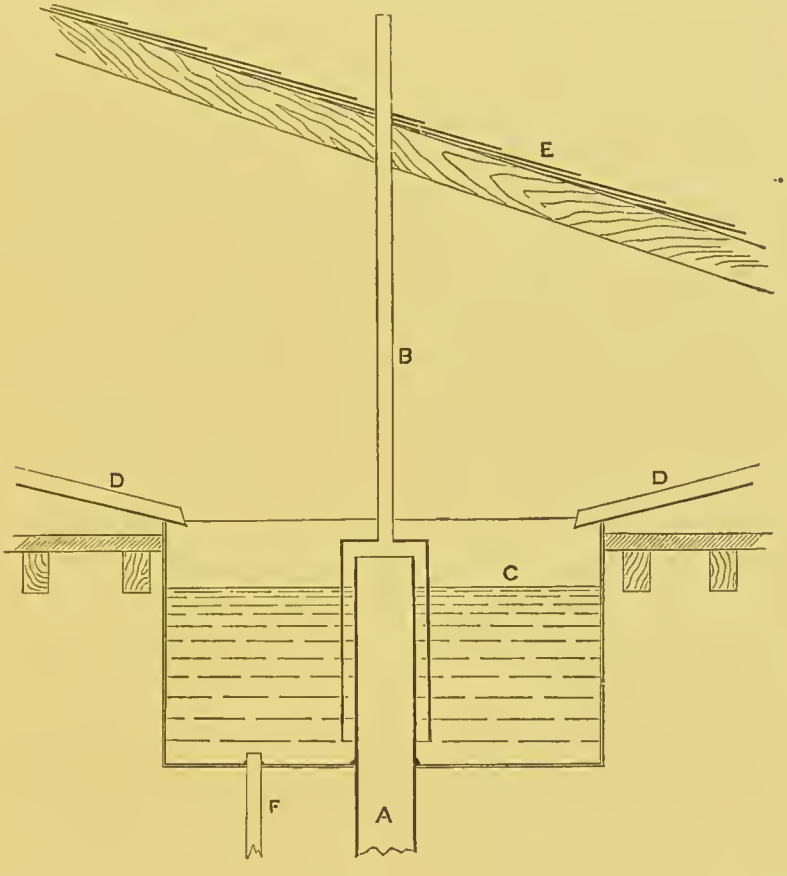


Fig. 70.

basement. It will be seen also that the soil pipe receives the cistern overflow pipe, the effect being that the soil pipe is ventilated into the cistern room. A is the soil pipe, D the drain, C the cistern, and B the overflow. There is nothing very unusual about this arrangement, bad as it is, except that where a cistern overflow is carried into a soil pipe the connection is usually made inside the house, the plumber probably being conscious that he is doing something irregular. To bring a cistern overflow through an external wall, carry it down some distance, and deliberately connect it with an unventilated soil pipe, would

appear to argue an unconsciousness of wrongdoing in the workman, and to indicate that he had never been properly instructed.

Fig. 70 represents part of a series of defects found in each of fifteen suburban residences, erected about twelve years ago. The soil pipe, of 4in. cast-iron pipes, was carried up through the bottom of the rain-water cistern to within two or three inches of the top, and made to act the part of overflow for the cistern. This is marked A in the cut. A zinc cap, in diameter two inches larger than the soil pipe, was placed in position over the end of this pipe, as a bell over a sink pipe. A zinc pipe B, an inch in diameter, was soldered round a hole at the top of the zinc cap, and the upper extremity continued above through the roof E, as shown. C is the rain-water cistern for flushing the closets, D and D the gutters from the roof, and F the flush pipe. As the soil pipe was directly connected with the main sewer, and the closet, soil pipe, and cistern were situated in the centre of the house, with no ventilation to the closet, sanitary arrangements could scarcely have been more defective. There were, however, houses in the same district in which the soil pipes were found continued upwards into the cisterns, and where not even one inch ventilators had been provided.

VII.—HOUSE DRAINS.

PLANNING and laying the drains of a house undoubtedly require some special knowledge, but, as the examples of bad work which I have collected appear to indicate, defects in drains are quite as much due to a lack of honesty and intelligence in the plumber and drainer as to any want of special knowledge. The more obvious requirements are :—

1. That drains should be laid wholly outside the house.

2. That house drains should be made of glazed earthenware pipes, provided with flanges, and, of course, free from flaws and cracks.

3. That pipes should be properly laid with a sufficient fall, and tightly jointed with cement; and when a connection has to be made a suitable junction pipe should be used.

4. That the soil pipes and traps receiving yard drainage, waste water, &c., should be properly connected with cement joints, suitable curved pipes and junction pipes being used as required. Greasy water should not be received directly into a drain, but through a grease trap.

5. That at a sufficient distance from the house there should be a fresh-air inlet, and just beyond this a suitable trap. The fresh-air inlet may be a pipe brought up from the drain to the ground level; but a properly-constructed manhole is far better, when practicable.

6. That the drain of every house should deliver separately into a sewer.

As regards this last requirement, it may be said that it is not always possible to comply with it. In rural districts this may be so; but in towns, if the local authorities do their duty, the requirement is just and reasonable. A not unusual cause of nuisance is draining two or three houses or more into a common drain, and then delivering this into a sewer, instead of providing each house with a separate outlet to the sewer, a drain common to several houses being especially liable to become obstructed. I regret to say, also, the practice still obtains of draining certain houses into cesspools, when they happen to be more than a hundred feet from a sewer, and that this practice receives the sanction of an Act of Parliament (38 and 39 Vict., 55 ch. 23 sec.). These cesspools are rarely water-tight when first constructed, and none remain so. Thus the contents leak out and pollute the land all around, and possibly contiguous wells. I pass on now to the examples of bad work under this heading.

Fig. 71 represents a manner of connecting the soil pipe to the drain which I hope is exceptional in any town. To me it was certainly a new experience. Complaint was received of an effluvium nuisance in the front parlour of a small semi-detached villa, rented at about £20. On examination it was found that the soil pipe, which received also the bath waste, was carried into a 6in. earthenware junction pipe. The straight end of this pipe had been broken off in order to make it come close enough to the wall, and the broken end was *not stopped*. Of course, foul water penetrated through the wall just above the footings into the space beneath the parlour joists. A is the soil pipe and B the junction pipe.

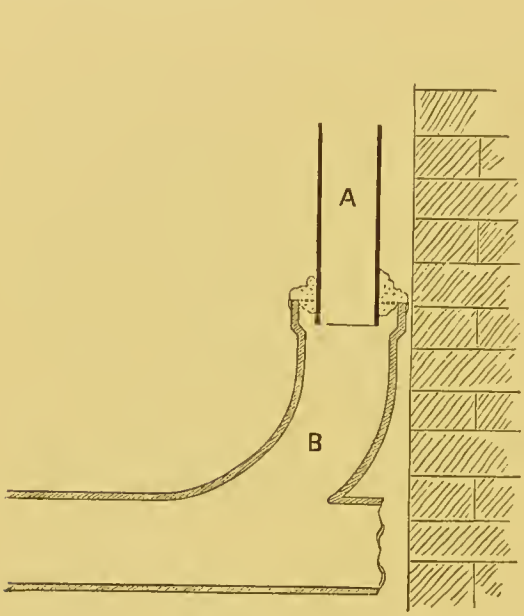


Fig. 71.

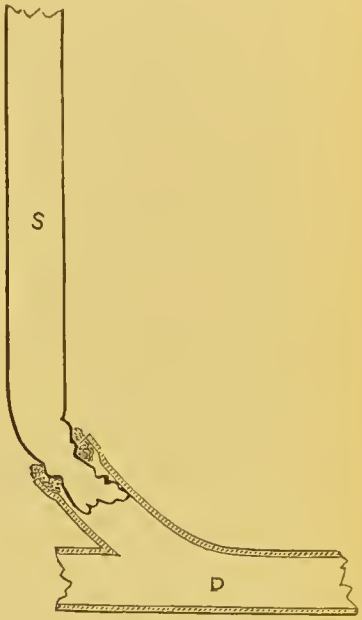


Fig. 72.

Fig. 72 shows a lead soil pipe S connected by a junction pipe D to the house drain. Instead of making a proper joint the workman had crumpled up the end of the soil pipe, and roughly thrust it into the pipe anyhow. It was cemented round, so that the joint did not actually leak, but at the joint the capacity of the soil pipe was reduced from being 4in. in diameter to being scarcely 2in., thus preparing the way for a stoppage sooner or later.

Fig. 73 was sent by a correspondent in one of the largest towns in the kingdom. It represents an unventilated soil pipe, imperfectly connected with the trap at the foot. The connection consisted of four slates laid round the end of the soil pipe and trap. The result was that the contents of the soil pipe soaked into the ground and the contiguous portion of the wall, causing an effluvium nuisance inside the house. A indicates the soil pipe, B the trap, and C the saturated portion of the wall. Here

are three defects—the bad connection, the absence of a ventilator, and the trap at the foot of the soil pipe.

Fig. 74, received from a correspondent, is rightly described by him as a foul-gas generator. It represents a soil pipe S, and a waste pipe from pantry sink and bath, P and B, delivering into a covered pit measuring 2½ft. by 1½ft. and 2½ft. wide, and furnished with a mid-feather and outlet D, as shown. This arrangement was provided at a large house, and the workmanship was excellent though misapplied. The object of such a pit is merely to break the connection between the house and the public sewer, which can be done in a much more simple way, but what it actually becomes is a tank for intercepting the solids brought down by the soil pipe, and this is stirred up from time to time by the warm water discharged with considerable force from the pantry sink and bath.

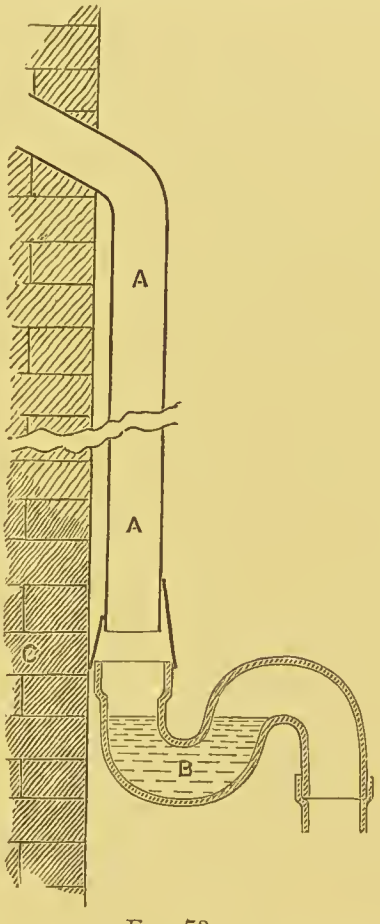


Fig 73.

Fig. 75 illustrates the cause of a nuisance in a suburban villa. On inspection it was found that the 6in. drain from the closet came to an abrupt termination close to the garden wall dividing this property from the next. The end of it had been deliberately closed up as shown at A, and the drain was full and leaking at some of the joints. A reference showed that two villas were built at the same time, and were allowed to drain together to the same sewer in front. Subsequently the villa in which the nuisance occurred was sold, and the other remained the property of the builder. It seems probable that about the date of the sale the vendor must have severed the drain from the villa he was selling, and reserved the drain running down his garden for the exclusive use of his own villa. A similar case was brought under my attention some time since. A drain serving two adjoining houses became frequently choked, and the tenants quarrelled about the payment of the charges made for cleansing it. Eventually the tenant of the garden in which the drain was situated cut off his neighbour's drain. Here, however. the disconnection was done openly and avowedly, and no attempt was made to close the end of the pipe, so that the resulting nuisance was manifest, and a separate drain was provided without delay.

Fig. 76 shows a defect in the drain of another suburban villa. Foul water was coming in through the wall and under the footings of the side of the house nearest the drain, and the drain was exposed and examined. Some of the 6in. glazed earthenware pipes D were found to be defective, the spigot ends having warped and got out of shape before being burnt, so that they would not slip into the flanges. Such pipes should, of course,

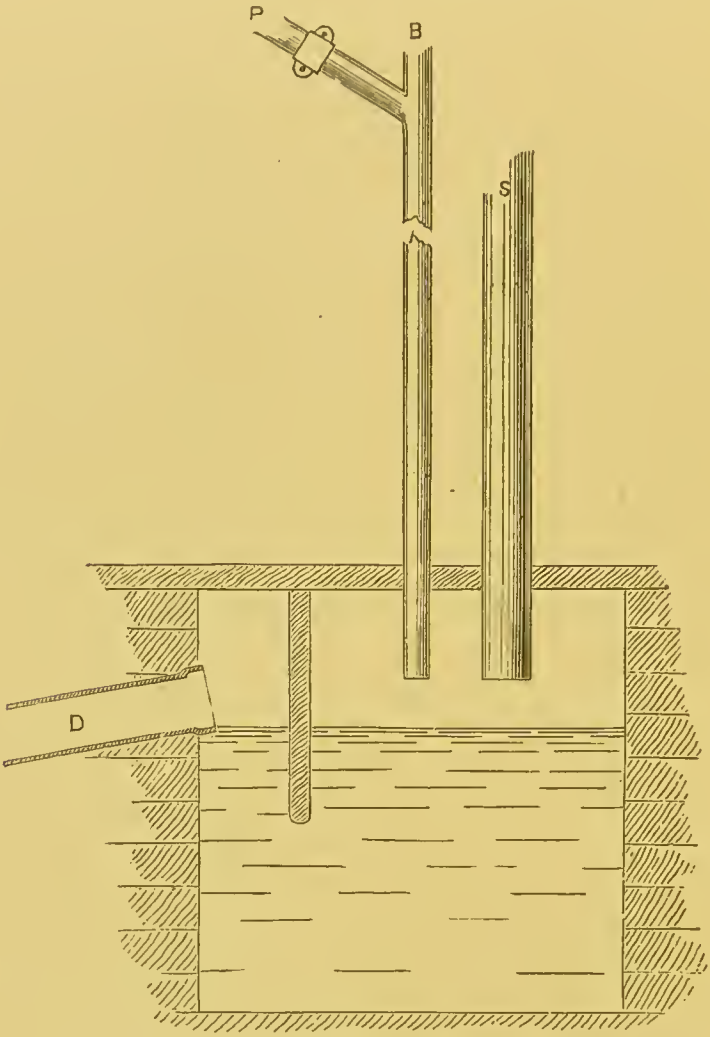


Fig. 74.

have been discarded. However, the spigot ends had been chipped round, and very ineffectual joints made with stiff clay. The cause of the nuisance was thus manifest.

The four illustrations, Figs. 77 to 80, to which attention is now called, represent defects discovered in a suburban house rated at about £70 per annum. The present tenant, in moving into the house a few years since, had had new closets put in, the soil pipe carried down outside, and the waste and overflow pipes

disconnected. As, however, one of the inmates of the house became seriously ill, and an effluvium nuisance was noticed in a pantry adjoining the kitchen, the premises were thoroughly examined. The external wall of the pantry was found to be soaked with foul water, and the drains which ran close to the footings of this wall were ordered to be exposed for the whole length. A worse laid drain it would be hard to find anywhere.

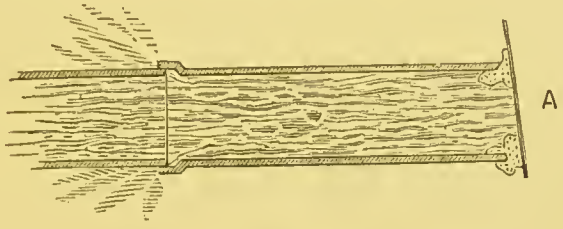


Fig. 75.

Fig. 77 shows a small portion in elevation. The horizontal line at the top indicates the level. Pipe A and the next to the left were about the fall intended, pipe B was dead level, pipes C and D were at different inclinations, the fall in both instances being the wrong way; beyond was a pipe with a slight inclination in the right direction. The joints were, almost without exception, imperfect, some allowing the contents to escape freely.

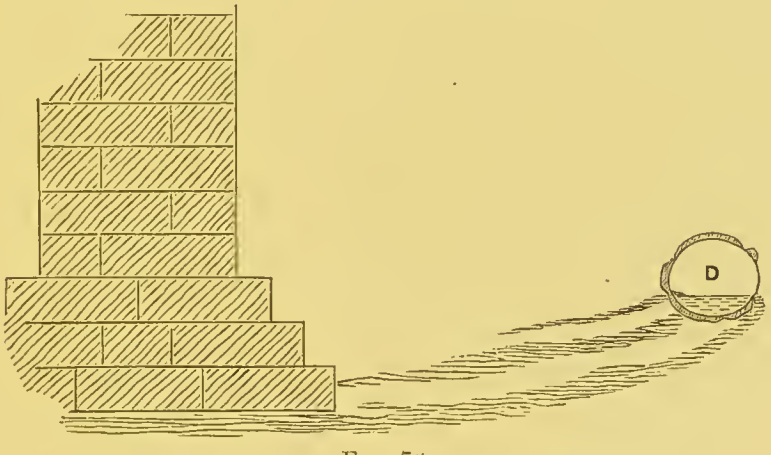


Fig. 76

Fig. 78 shows another small portion. It will be noticed that two pipes are placed with the plain ends together, leaving an open joint at A, and the flange is broken off the pipe at B. Many of the flanges were found to be broken, and plain ends were placed together at two or three points.

Fig. 79 represents the exact appearance of three pipes when the earth was removed from them. They are seen in plan, that is from above. At A is a 4in. junction, fractured right across, no proper bed having been made to support the pipe beneath.

At B is a 4in. pipe with a large hole knocked in it, imperfectly stopped with a piece of slate. This was probably done to clean

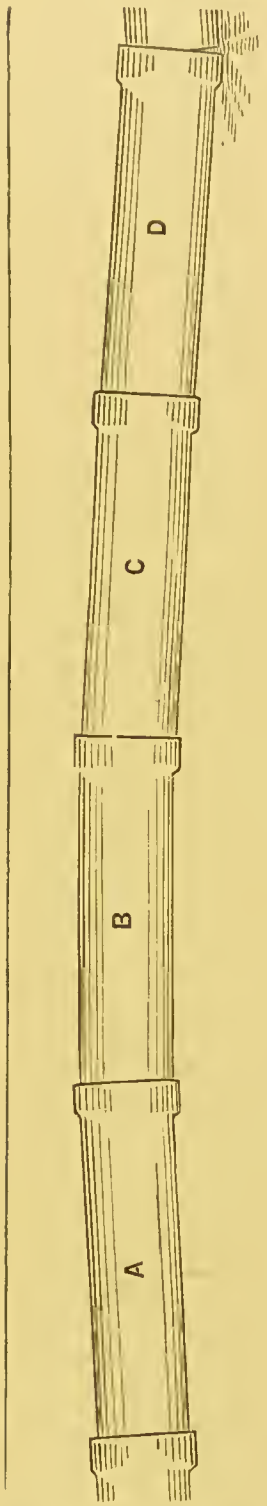


Fig. 77.

Fig. 78.

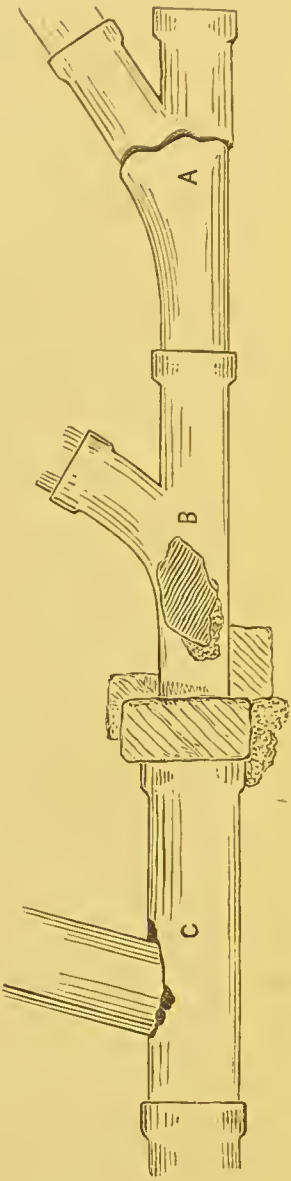


Fig. 79.

the drain. Pipe B delivers into a 6in. pipe, there being a distance of fully 4in. between the pipes, the joint being roughly

made with brickbats and mortar. At C a hole had been knocked in this 6in. pipe, and another 6in. pipe from a gully trap roughly brought into it as shown. These three pipes are three consecutive pipes just as discovered. Of course the leakage from such a drain was enough to account for dampness in the neighbouring wall. However, the worst part of the drain is shown in section in

Fig. 80. A gully trap A, on which a waste pipe delivered, was brought into a cesspit B, loosely made with brick sides and a broken slate bottom; a 6in. earthenware pipe, as shown at E,

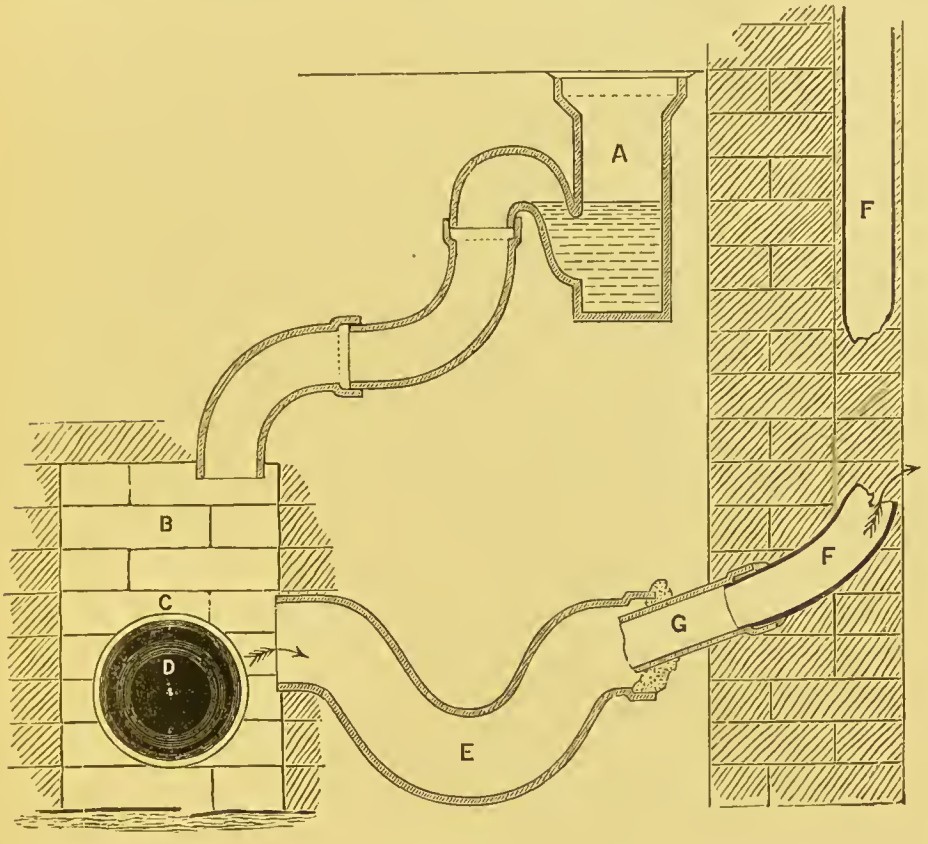


Fig. 80.

also opened into this cesspit. This was connected, by means of a piece of 4in. earthenware pipe G, with an old soil pipe F. About 10in. of the old soil pipe had been removed, but neither extremity had been sealed, except with the wall plaster. When the old closets had been taken away their soil pipe had been left. As the cesspit seemed designed for the purpose of retaining some of the solids passed into the drain it formed part of, its contents were as foul as they could possibly be, and as the pipe trap E contained no trapping water, the drain gases, after being passed over the accumulation of stagnant filth, had access into the house, the only check offered being a thin layer of plaster, which was,

of course, porous. The pipe delivering into the cesspit was a 6in.; the first length of pipe leading from it was a 9in. C, and this delivered into a 6in. pipe D. There was no joint whatever between C and D, the end of D being simply slipped into C.

Fig. 81 represents defects in the drains in the basement of a large house I recently examined. A and B are glazed earthenware pipe drains, carrying slop water, and these, with C (an

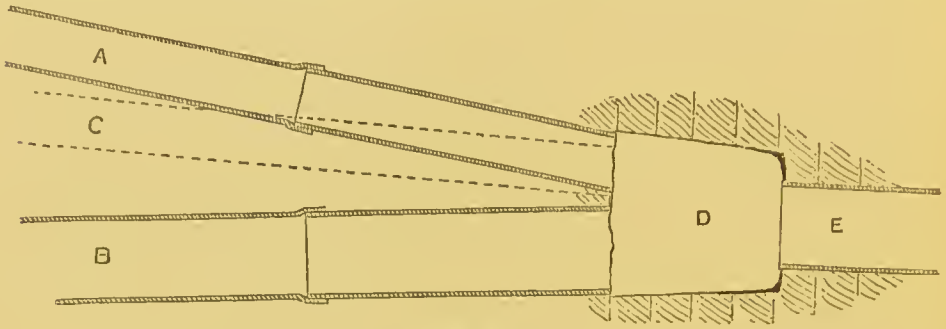


Fig. 81.

old land drain just below A), are made to deliver into a small chamber D, and thence through the glazed earthenware pipe E. Drains should not be laid in the basement of a house, even if they only carry slop water. In this instance the joints were defective, and the flanged ends of the pipes all directed towards the outfall. However, the special defect to which attention is drawn by this illustration is connecting a land drain, roughly

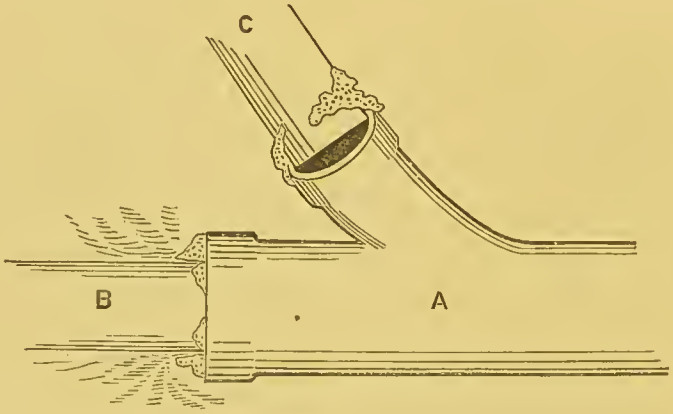


Fig. 82.

made of brick, and never designed to be water-tight, with drains carrying slop water. Had an obstruction taken place at E the slop water would have been delivered by C into the basement of the house, and caused no ordinary nuisance.

Fig. 82 represents a portion of a back passage drain, as seen from above. The drain should have been a 9in. drain with 6in. junctions. The drains of one of the houses delivering into it being obstructed, the passage drain was uncovered in rear of

this house, and defects as shown were discovered. The pipe A was so tilted up that the end of pipe C did not fit into the socket meant to receive it, and B, which should have been a 9in. pipe, was a 6in. one. The joints were in part made of clay,

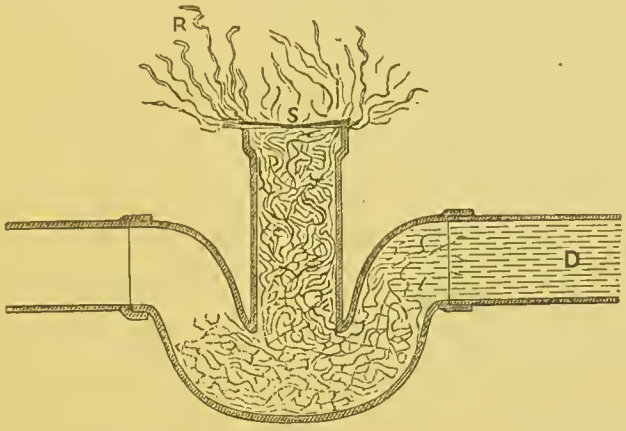


FIG. 83.

and were defective. At the joint between A and B the drain contents had leaked out, and at the joint between A and C the earth above had got into the drain.

Fig. 83 represents the cause of a stoppage in a 6in. glazed earthenware pipe drain from a large house. The drain was laid

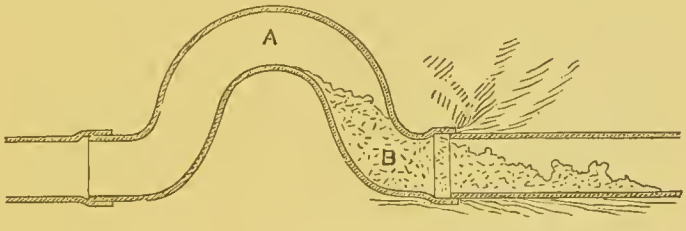


FIG. 84.

thirteen years since, the fall was sufficient, and the joints were carefully made with cement. However, as it passed under a plantation of young trees, and within a few feet of the boundary wall dividing the property from the road, a trap had been

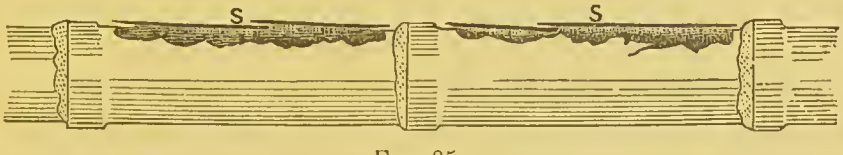


FIG. 85.

inserted, as shown in the cut. The mouth of the perpendicular pipe of this trap was six feet from the ground surface, and being merely covered with a piece of slate, the roots (R) of the young trees (in their search for water) found their way in, and a dense mass of fine root ends felted together, filled the pipe, entirely

obstructing the drain. S is the slate placed on the flange of the upright pipe, and D is the drain silted up on the house side of the felt plug. Cases have been brought to my notice before where roots have found their way into pipes through bad joints, but I never before saw a case quite similar to this. If the upright portion of the trap had been continued up to the surface, or if the opening had simply been cemented over, the roots would have been kept out.

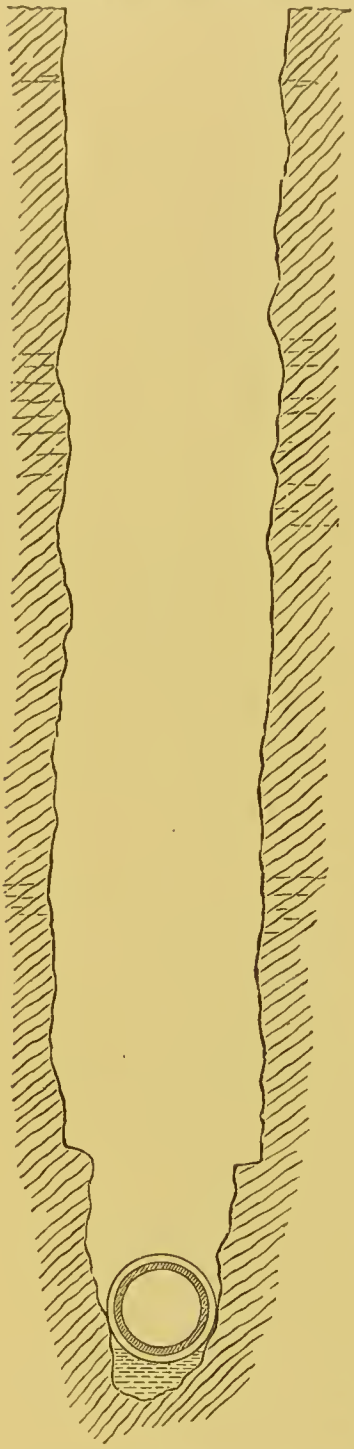


Fig. 86.

Fig. 84 illustrates an instance of remarkable stupidity that came under the observation of a correspondent from a small urban district. A 4in. earthenware pipe drain was not running, and it was exposed at the point where the stoppage appeared to be. The cause of the obstruction was at once brought to view. A trap had been introduced in the course of the drain, but it had been set *upside down*. None of the joints were properly made, and the pipe delivering into the trap had not been pressed into the flange that received it, and the drain contents had leaked out at this joint, saturating the surrounding earth. A is the trap set upside down, and B is the solid matter causing the obstruction.

Fig. 85 shows two lengths of 6in. pipe from a scullery in a large house used as a school for young ladies. A grease trap not having been provided, it was found that the drain frequently required cleansing, and large holes had been broken into two pipes to enable this cleansing to be done at short intervals. The holes were covered by slates SS, and over these were flags. The drain was trapped before it discharged into the sewer, so that there was no risk of sewer gas finding its way into the schoolhouse yard through these roughly-cut openings. Of course, if a grease trap had been provided, there would have been no occasion for such openings. When, for any reason, occasional

access to pipes is required, suitable pipes made with openings and water-tight lids may be obtained.

Fig. 86 indicates one of the causes of defective joints in drains. Defects were suspected in the drains of a good-class house built on the new red sandstone, and set back a little from the road. The main drain was exposed. It extended from the rear of the premises to the sewer, a distance of 75 feet, and was at the bottom of a very narrow cutting, as in the figure. It was a 6in. earthenware pipe drain; and considering the width of the cutting

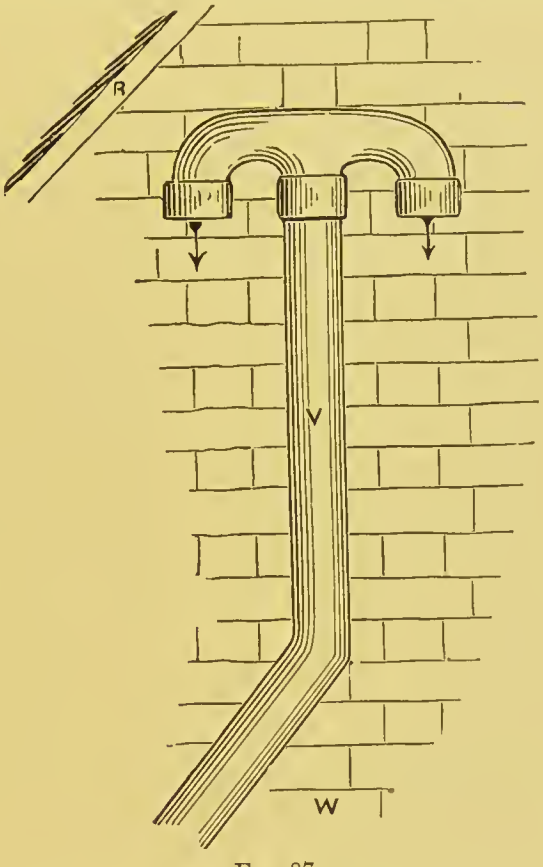


Fig. 87.

in which it was laid it was not surprising to find all the joints imperfect. Of course, the object in taking out so little of the sandstone was to avoid expense; and it is not unlikely that the draining of the premises was a "contract job," tendered for at too low a figure. Near the pipe were two ledges, evidently designed to give the pipe layer a foothold; but it would have been quite impossible for any pipe layer to have laid a drain and made perfect joints in so narrow a trench. On taking up the pipes, it appeared that the main channel for the drainage from the house had been the bottom of the trench below the pipes—at all events much of the contents of the pipes had leaked into this channel. The figure explains itself.

Fig. 87 shows the upper extremity of a drain ventilator. It was fixed to the gable wall of a large house, and instead of being carried up above the roof, in the usual way, it was turned obliquely to the right, apparently for no other purpose than to bring it over a window, and then it was capped with a terminal to direct any foul air it discharged downwards towards the window. V indicates the ventilator, which, with the terminal, was of 4in. cast-iron pipe. R shows a portion of the roof, and W indicates the position of the bricks just above the top of the window.

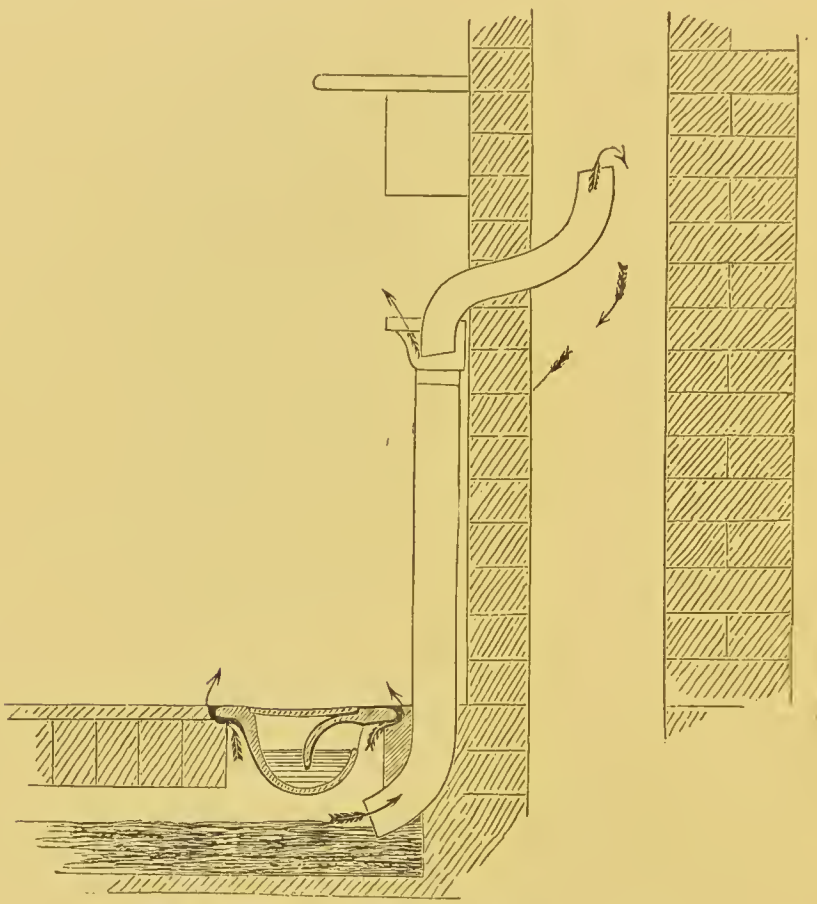


Fig. 88.

Fig. 88 represents a resident owner's attempt to remedy a defect in his house. In the basement of the premises was a rubble drain, laid without fall, the entrance to which was guarded by a loose D trap. Such a drain (it was continued from this house under three or four others) was necessarily a drain of deposit, and the effluvia arising therefrom had free access to the house, the traps notwithstanding. The owner thought he could remedy the nuisance by fixing a perpendicular pipe as shown, through which he could flush the drain and keep it clean.

The pipe was accordingly fixed, and buckets of water poured down, but the nuisance remained. Having an idea (not an uncommon one) that the current of air is always upwards in a chimney, the

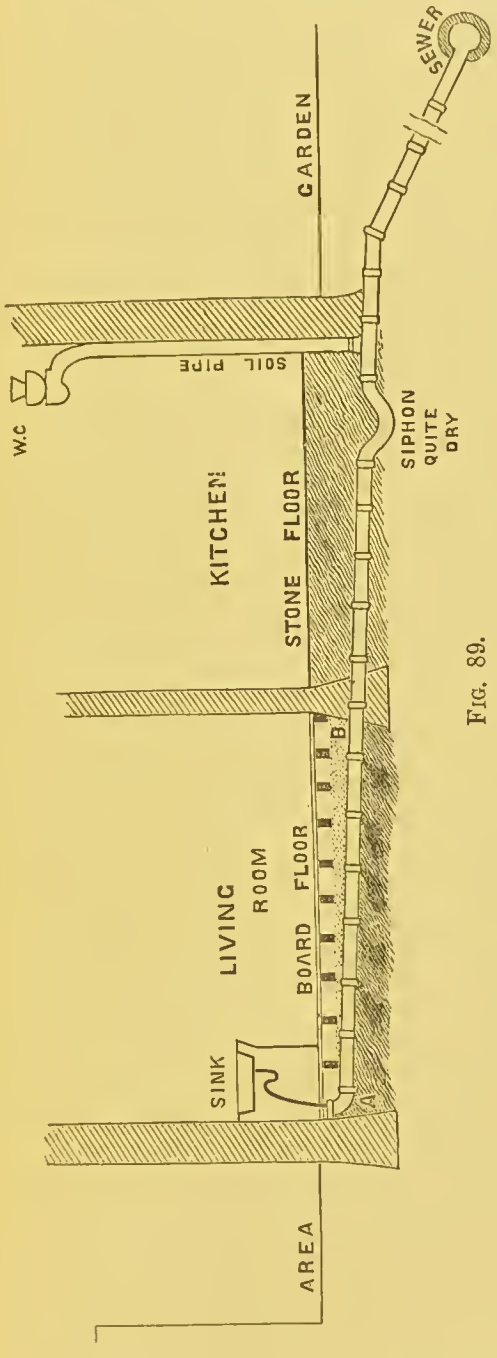


Fig. 89.

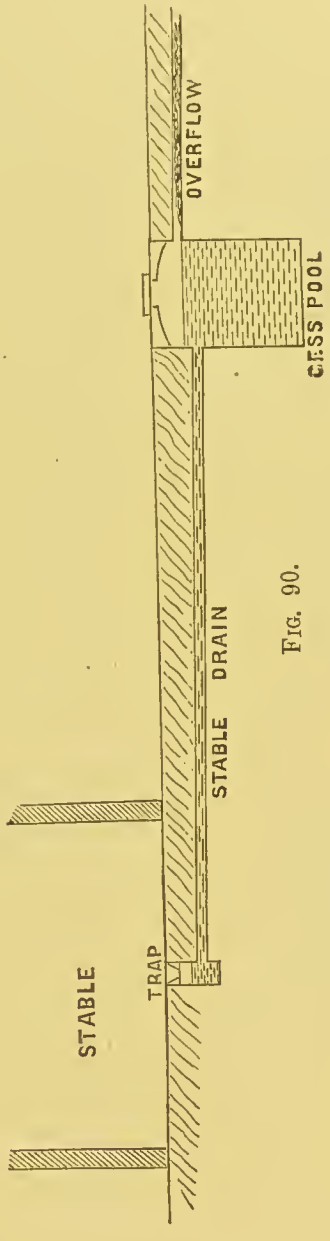


Fig. 90.

owner next carried a pipe, from the head of the flushing pipe, for about a foot up the chimney. The result of the owner's remedial measures was that the effluvia, instead of coming up merely at the edges of the loose trap, had free exit at the flushing

pipe head, and when there was a down draught, as there often was, the short ventilator into the flue delivered foul air into the chimney, only to be blown back into the room.

Fig. 89 shows the sanitary arrangements of a large boarding-house at an inland watering-place. The correspondent who supplied the sketch was recently called on to make an investigation, and the section of the basement of the building represented in the cut correctly indicates what he discovered. My correspondent writes: "There was no intercepting trap between the public sewer and house connections, but a syphon trap had recently been inserted in the drain passing under the house, and new pipes had been laid under the living room. This had been done to get rid of a bad smell which had been noticed in the living room. On pulling up the floor of the living room I found the pipes laid on the ground, the joints being quite open, the pipes loose, and partially covered with sawdust. The sawdust and soil were saturated with foul water from the sink in the pantry adjoining the living room, the water from this sink having all escaped through the open joints. Although the trap under the kitchen floor had been inserted nearly a year, no water had ever reached it. The sewer gas had therefore free access to the house by the living room." A is the saturated soil and B the saturated sawdust. All the joints from A to B were open.

Fig. 90, which was received with the above, is a section showing the arrangements found at large stables, where, an epizootic among the horses had led to an investigation. The drain was of brick, 6in. by 6in., laid without mortar or cement; the cesspool was 7ft. by 4ft., and 5ft. deep; and the overflow was made of agricultural drainage pipes. "On opening up," writes my correspondent, "I found the stable drain charged and the overflow blocked. The overflow had been placed at too high a level, and the drain itself was flat. On the same premises the overflow from the cistern from which water was obtained for the horses had direct communication with a cesspool."

On examining a large old house in the suburbs (where there had been complaints of effluvia and sickness, which the practitioner in attendance thought pointed to insanitary conditions), a defective brick sewer was found under the premises, and the cause of nuisance indicated. The house was conveniently situated for draining into the town sewer, but the old sewer originally provided, running under the garden and delivering into the river, had not been interfered with. The tenant had been induced to think that the drains were properly arranged, and external to the house, *as the soil pipe was carried down outside.* I pointed out that it was not ventilated, and on removing the earth at the foot brought to light the old sewer

running under the house. The length of iron soil pipe (4½in. pipe) had not been quite long enough to reach to the sewer, so a hole had been roughly cut in the sewer and the soil pipe delivered over it, no joint having been attempted. In Fig. 91, S is the lead soil pipe properly jointed to an iron soil pipe. The way this delivered into the drain D is shown.

Fig. 92 represents an untrapped drain in a washhouse adjoining a kitchen. Complaint was received from the occupant

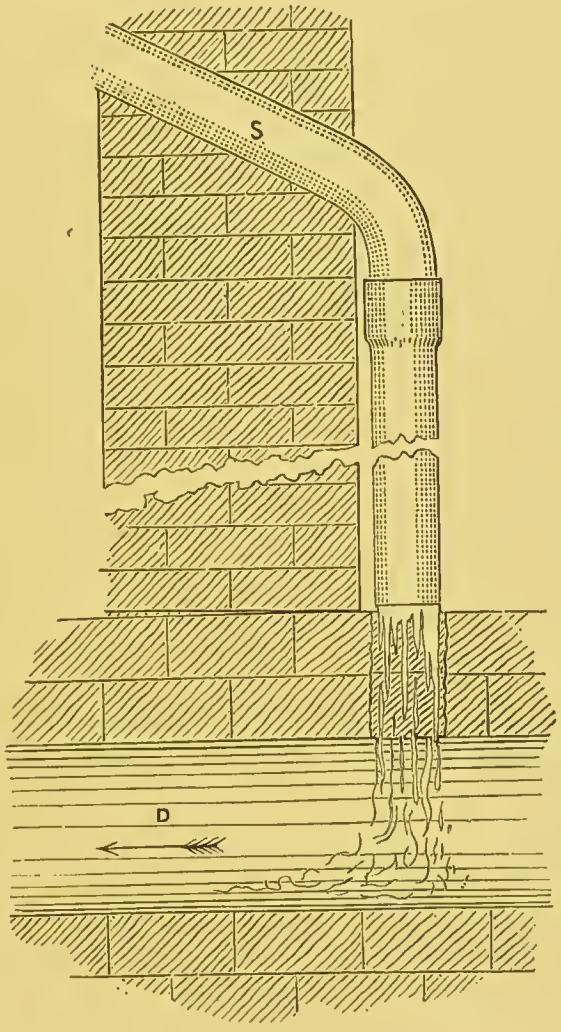


Fig. 91.

of the premises of an effluvium nuisance. Two fixed washtubs discharged over a grating in the floor, and on the grating being removed it was found that the washhouse drain was without a trap of any kind, and delivered into the sewer direct. The arrangement is shown in the illustration. The owner of the house was a builder, and yet when communicated with and directed to abate the nuisance he at first insisted on connecting

the waste pipes from the washtubs with the washhouse drain. It was pointed out to him that this could not check the ingress of sewer gas, but would merely deliver it at a higher level, and that whether the waste pipes from the tubs were connected with the washhouse drain or not, the latter would have to be severed from the sewer by a gully trap, or in some other efficient manner.

Fig. 93 shows in section a sink as fitted in the basement of a small house let at about 8s. a week. The sink waste pipe was trapped with a large iron (*f*) trap, and delivered into a 4in. glazed earthenware pipe, and thus to the drain. The basement being used as a washhouse, some sort of drain was required for the floor, and this was provided in the following way: A small dish-shaped depression was made near the sink, and a short

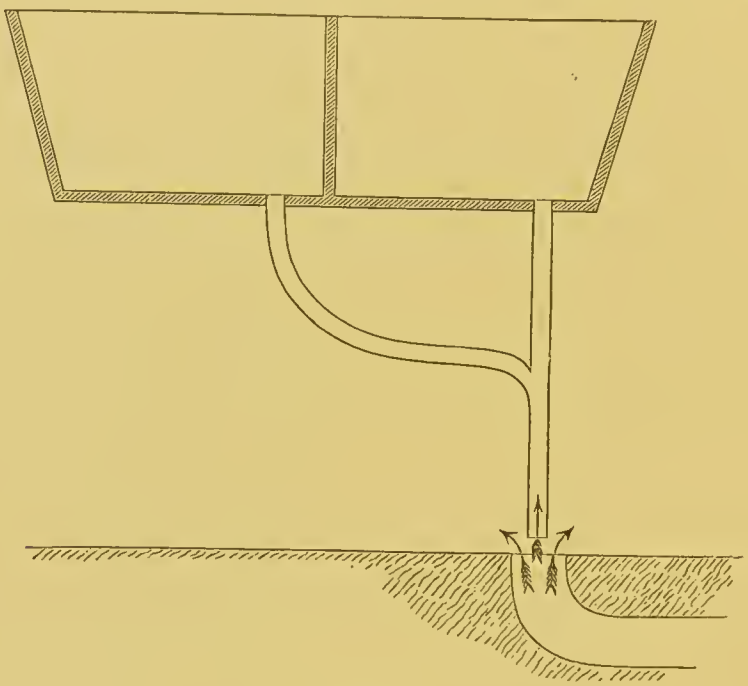


Fig. 92.

length of iron pipe carried from this to the glazed earthenware pipe. This iron pipe was fitted with a brass cap, which screwed on. After the washing was over for the day, the cap was screwed off and the tubs emptied, and then the cap screwed on again. Of course, in practice, the cap was not always screwed on at once; and one night that it chanced to be left off, the effluvium nuisance was so bad as to cause the woman of the house to get up and search for the cap and put it on. A is the sink, B the iron trap, and C the glazed earthenware pipe. The whole arrangement was unworkmanlike, but B was jointed to C quite securely with cement, and the floor near the sink was finished off with cement, so that the only direct communication between

the inside of the house and the drain was through the short iron pipe described.

Fig. 94 represents a curious case of obstruction which I discovered in making an examination of a very large house. It was ascertained that the obstruction was in an old drain under

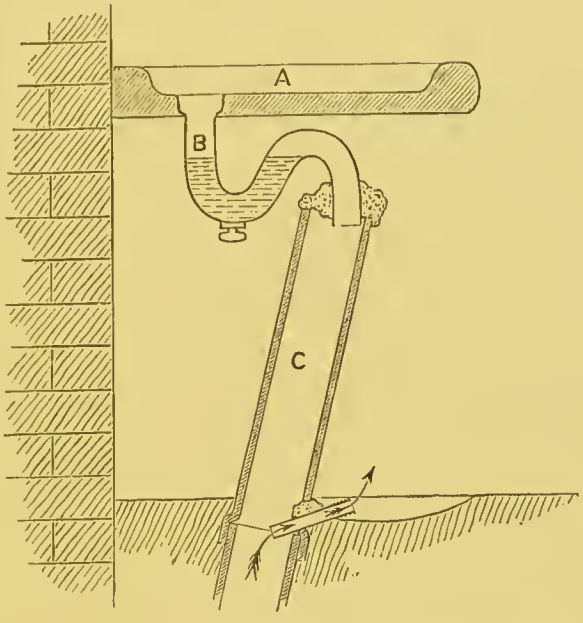


Fig. 93.

the area. On removing the flags a square brick-lined drain was brought to view, and crossing this obliquely was a 6in. pipe drain, which was the immediate cause of the obstruction. The pipe drain had been laid in connection with additional sanitary accommodation recently provided, and those responsible for the work seem to have been indifferent as to the effect it must have

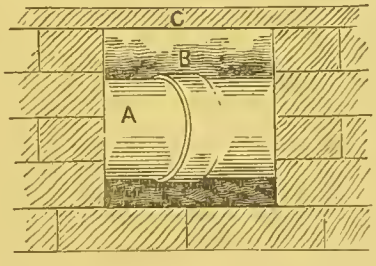


Fig. 94.

on the old drain. A is the pipe drain, B the old brick drain shown in section, and C the area flagging.

Fig. 95 is a specimen of ill-planned work in connection with a hospital. One of the peculiar features of the hospital is that there are two distinct drainage systems—one for so-called "sewage," which is specially treated, and one for surface water,

which passes into a pond. It was arranged that all bath and lavatory waste water was to pass into the foul water, or "sewage" system. As the work was carried out, it seems to have been left to chance as to which system of drains the waste pipes delivered into. A is a rain spout from the roof, delivering on a gully trap G, *connected with the surface water drain*; B and C are dis-

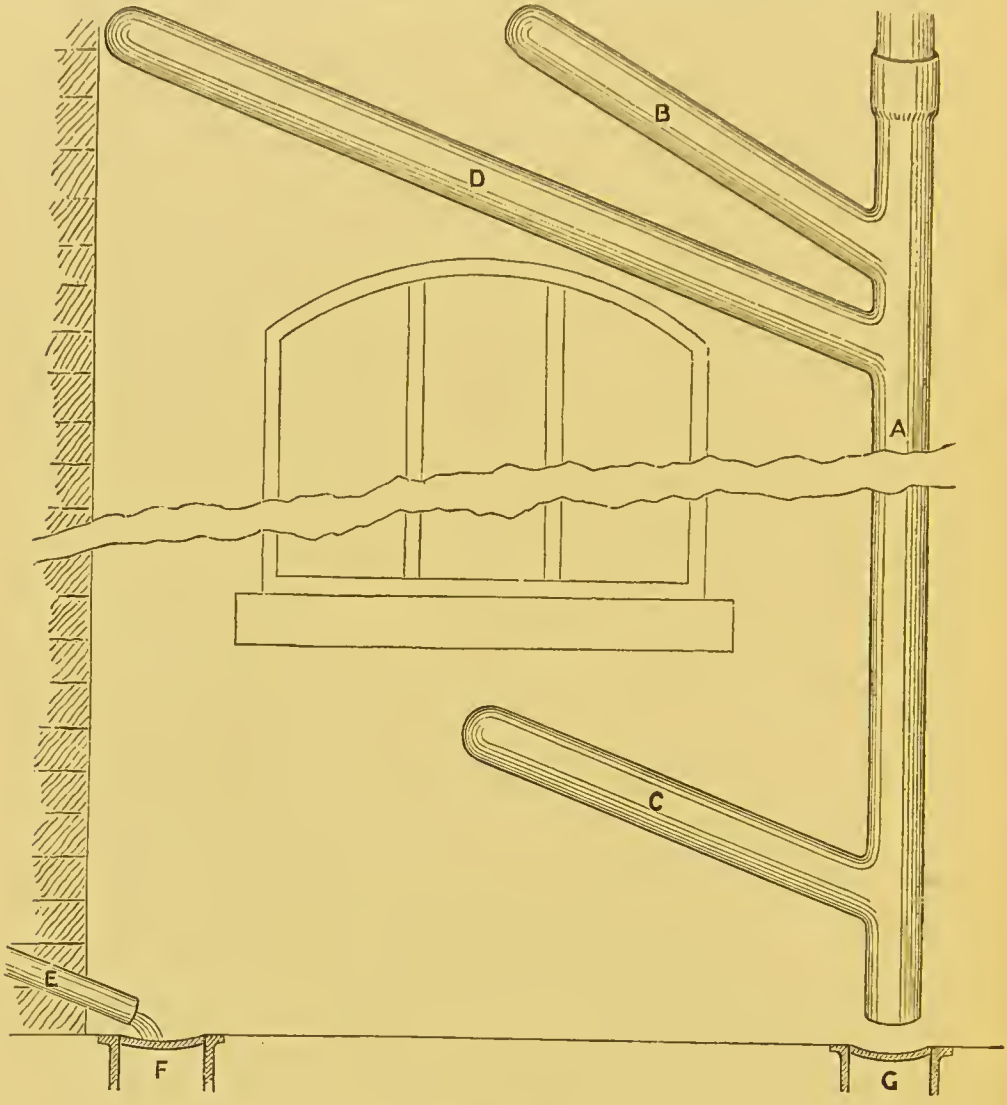


Fig. 95.

charge pipes from the first floor and ground floor lavatories; D is the discharge pipe from the first floor bath—all these being connected with the rain spout A. E is the discharge pipe from the ground floor bath, delivering on a gully trap F, *connected with the foul water drain.* The 4in. earthenware pipe drain leading from F crossed over the 4in. earthenware pipe drain from G, the one lying almost close to the other. A, B, C, and

D are 4in. iron pipes. E is a small lead pipe, as shown. "The object of this blundering," writes the correspondent who furnishes me with these particulars, "is difficult to see, as it would have been far simpler to discharge all the bath and lavatory water on a grid in F." The most economical way of remedying the mistake appeared to be to connect the gully G with the foul-water system, and this has now been done.

Fig. 96 shows the effects of not shoring up a wall before digging a trench close to the wall footings. Earth was removed

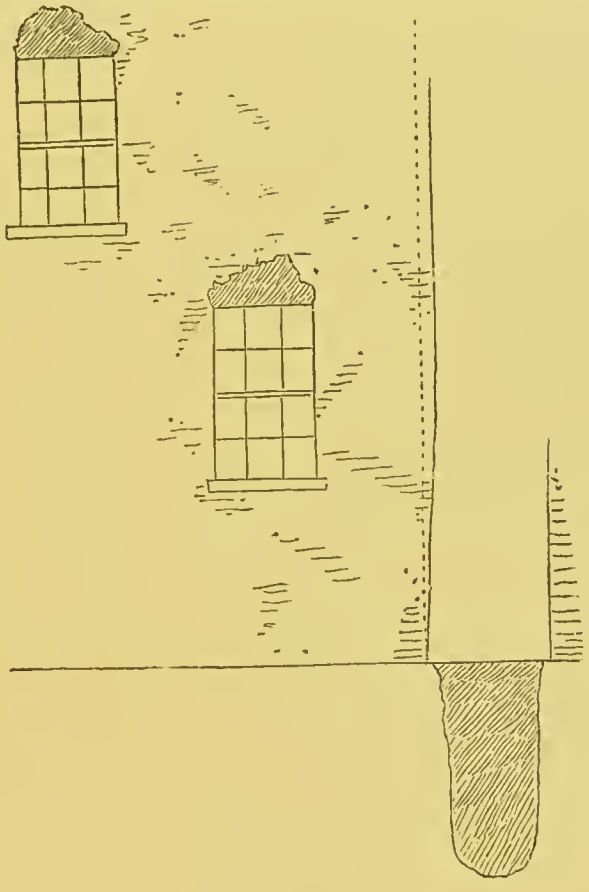
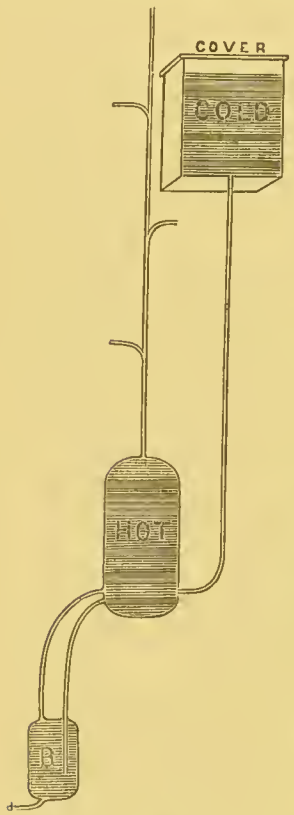


Fig. 96.

from a back passage, to the depth of about 9ft., in order to reconstruct a drain, and as a result the wall parallel to the trench got out of the perpendicular, as shown in the dotted lines in the sketch. Some time after the ground had been filled in, the brick arches over the windows fell out as indicated. Workmen often appear to think that shoring up the sides of the trench in such a case is sufficient. The house on the opposite side of the passage was much larger and higher, and thus not so liable to be affected.

VIII.—DOMESTIC CISTERNS, HOT AND COLD WATER APPARATUS.

SOME of the ways in which the water in a cistern may be polluted have been already referred to. Attention will now be drawn to three other ways, viz., by an overflow into a drain, by a so-called "air pipe," and by an overflow carried into a closet trap. However, I make no claim to have indicated all the ways by which cistern water may be polluted. The only safe course for the householder is not to use the water from a cistern serving a closet for any other purpose whatever, except the connection between the closet and the cistern be broken, the water for the closet passing through a separate service cistern; and to see that his household is provided with a separate and direct service from the main for drinking purposes.



As regards provision for hot water, the arrangements made are often quite as unsatisfactory as for cold. Doubtless it may be argued that an ill-designed contrivance for heating water is not as insidiously dangerous to health and life as serving contaminated water at a tap from which drinking water is drawn. Still, blunders in fixing boilers and the pipes connected therewith are frequently fatal blunders, and if no worse results be produced than "bumping," and occasional loud reports, nervous people may be robbed of their night's rest and the whole family kept in a state of constant alarm. The examples I have given of defective work under this head are but few, and might have been easily added to, still they are sufficient to show the sort of mistakes made in carrying out jobs requiring a little planning. Rather than add to my list of plumbers' blunders, I will here make a brief quotation from a paper which I published two years and a half ago. It is illustrated by a diagram.

The choosing and fixing of a suitable high-pressure boiler at the back of the kitchen fire, a hot water cylinder, and the circulating pipes in connection therewith, is a comparatively simple

piece of work. In the first place, a boiler should be selected which is quite smooth inside, the angles and corners being rounded off so that no air may lodge within. Iron soon roughens from the action of the water, and copper is therefore a better material for this boiler; but in every case an access hole, properly protected, should be provided. A pipe, securely stopped, should be taken from the very lowest point, for emptying the boiler previous to repairs, and a pipe should be taken from the very highest point as an outflow to the cylinder. The return pipe may be entered at the top or the back, and should be continued within the boiler by a short length of pipe.

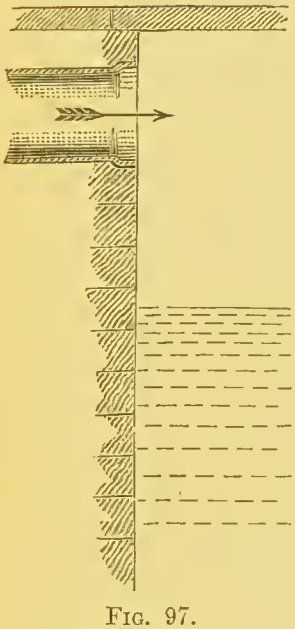


Fig. 97.

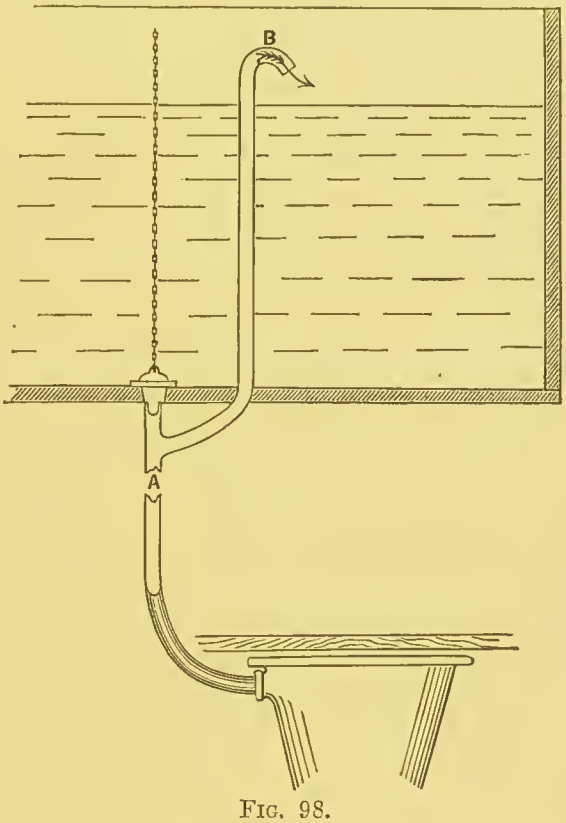


Fig. 98.

The hot water cylinder (a copper one is preferable) should be fixed not far from the boiler, but, of course, at a higher level, and access to every part of it and to the inside, securely protected, should be provided. The boiler outflow and return pipes should be connected at the bottom of the cylinder, and the supply of cold water from the store cistern may also be led in here. At the highest point of the cylinder the expansion pipe should be connected, going right up, and from this all the hot water supplies required can be branched.

Fig. 97 represents a portion of the interior of a terra cistern, the overflow pipe from which is carried directly into the drain. Connecting the cistern overflow to a drain is, I regret to say, a

not uncommon blunder, but in a cistern under the flags the fault is far more likely to be overlooked. As such cisterns are seldom more than half full, even if the overflow be trapped the water in the trap soon evaporates, and then the drain gases and effluvia come over on the water and up the pump ease. The house having the cistern referred to was a large one—rent £240 a year.

Fig. 98 represents a portion of the interior of a domestic store cistern, used for flushing a closet, and for other purposes. A is the flushing pipe brought down to the closet basin, and B is a so-called air pipe, which discharges foul air out of the flushing pipe on the surface of the water in the cistern. Of course it would be just as simple an arrangement for the air pipe to deliver externally, and if the flushing pipe is big enough no air pipe is required.

In a house in which there had been much sickness, and where there was reason to believe the water had become polluted, was found an old pan closet of the ordinary form—*vide* Fig. 99, A.

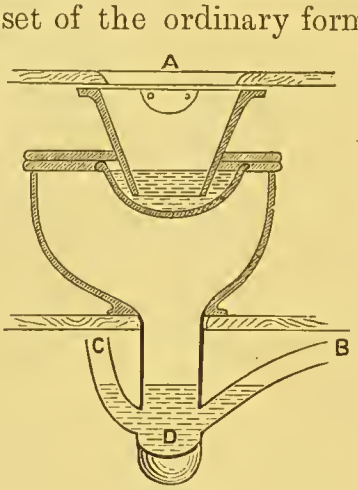
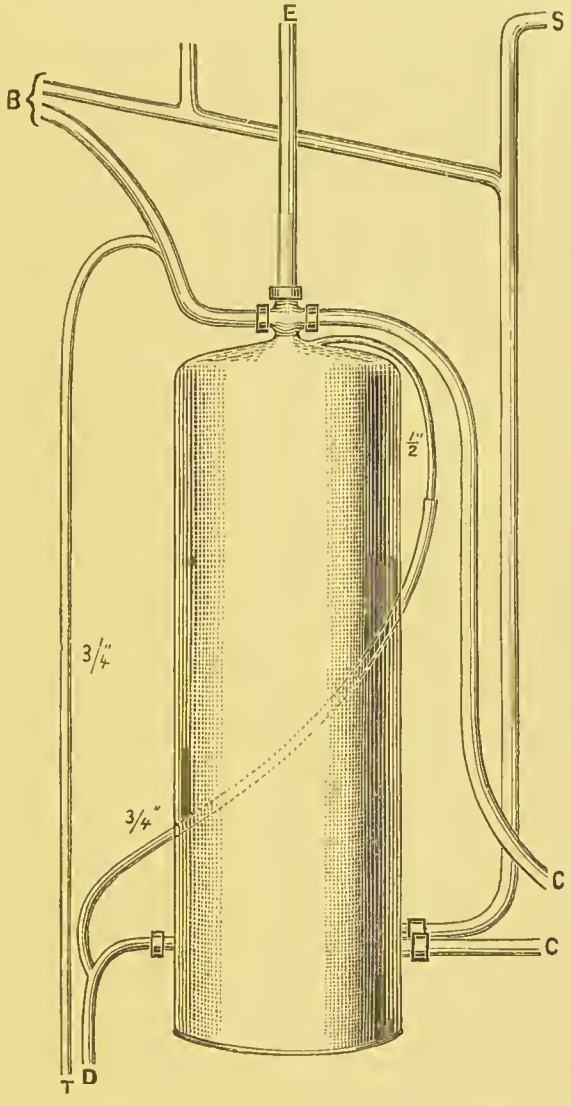


Fig. 99.

Into the trap D below were carried two pipes, the bath waste B entering on the one side and *the overflow from the cistern* C, at the top of the house, entering on the other side. The trap was continued as a soil pipe (inside the house and unventilated), delivering into an ill-jointed drain under the basement.

Fig. 100 illustrates an instance of defective plumbing which was made manifest owing to frost. I was informed that a copper cylinder, which had been fixed ten years since, and had hitherto given no trouble, had suddenly collapsed, the copper being rent in two places. On arriving at the premises I found the cylinder a hopeless wreck, and water still spurting from one of the rents. The cylinder measured 4ft. by 1⅓ft., and was fitted as shown. C and C are the circulating pipes, E the expansion pipe, S the cold supply, T a hot water tap for the kitchen, D the draw-off pipe for emptying the cylinder, which

was also used to supply a bath on the kitchen floor, and B a hot and cold pipe leading to a bath on an upper floor. I traced the supply pipe, and found that from the point S it was horizontal for 39ft., out of which 30ft. ran along an external wall, then it ascended along an external wall to a cistern, at the top of the house. It was not surprising that this pipe had frozen. The next thing was to trace the expansion pipe, which was led up



and made to pierce the roof, where the end had become choked with snow and ice. The bath had been in use once or twice since the frost, and as the cylinder cooled, the collapse had taken place. All the pipes were $1\frac{1}{4}$in. except those marked. It is not easy to understand the intention of the $\frac{3}{4}$in. extending from the pipe D, and continued as a $\frac{1}{2}$in. to the top of the cylinder. It appears to have been put in as an afterthought. Probably the water in the bath supplied from D was not found to be hot enough, as

it came from the cold end of the cylinder, and matters were improved in the "jerry" way indicated. It will be noticed that the return pipe from the boiler is entered at the top of the cylinder—the approved practice is to enter this as well as the flow at the bottom of the cylinder. It is interesting to note that although this cylinder collapsed it had been fitted with a

Fig. 101.

so-called "vacuum valve." The function of this little apparatus appears to be to give a false sense of security. How often it happens that when its services are really needed it is stiff and does not act!

The fixing of 39ft. of lead pipe horizontally, as just referred to, is work which would only be done by a careless or ignorant

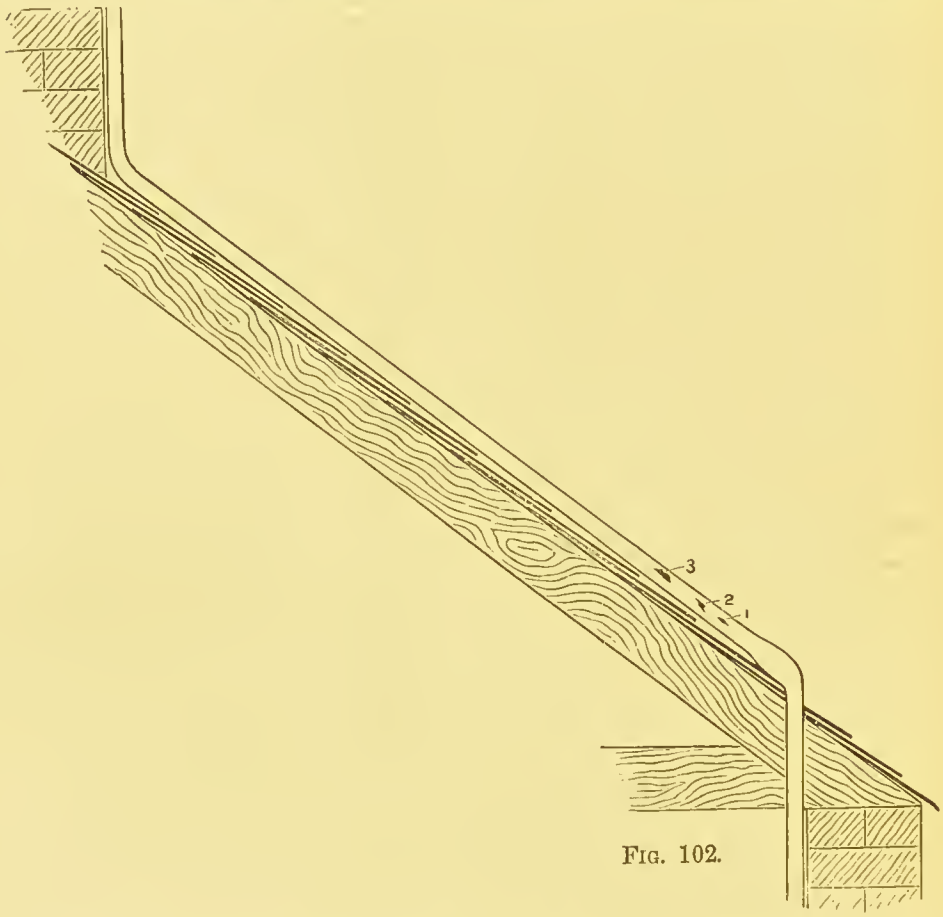


Fig. 102.

plumber. A pipe should always be given a sufficient fall to enable it to be emptied if required, and when nearly horizontal should be laid on a piece of wood.

The effect of fastening a lead pipe to a wall with metal clasps only is shown in Fig. 101. In course of time the weight of the

lead causes the pipe to bag, and the wider the clasps are apart the greater the bagging.

The next illustration, Fig. 102, shows the expansion pipe from a hot water cylinder, which was ruptured by frost three times between Christmas and the middle of January. Every plumber knows that an expansion pipe should not be exposed to the action of frost, yet the pipe shown was carried along the roof, unprotected for five feet, and then up a chimney for four feet. Just beyond the point where it pierced the roof there was a joint, and the first rupture occurred close to this at 1. After it was mended, a second rupture occurred at 2; and after this was mended, the pipe burst for the third time at 3. The

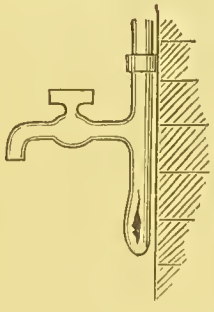


Fig. 103.

chimney was from a kitchen, and was practically always warm, and if the pipe, instead of being carried along the slates, had been made to pierce the roof where the chimney came through, it would have been efficiently protected from the action of frost.

The defect shown in Fig. 103 was noted by a correspondent. A service had been provided for the garden, and the tap not being placed at the lowest part of the branch a portion remained which could not be emptied. The water had been run off from the pipes and cistern, as a frost was expected, but, of course, the *cul de sac* remained full, and froze, and the lead was burst, as indicated in the cut. As soon as the water was turned on again the rent was made manifest.

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"Mr. John Heywood has sent us a box of 'Vacher's model bricks,' the peculiarity of which is that each piece is an aliquot portion of the whole, the sixty-four pieces combined being the size of an ordinary brick used in building. Exact lessons in architecture can thus be given."—*The Graphic*

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"From Mr. John Heywood, of Manchester, a box of 'Vacher's model bricks' has reached us, the peculiarity of which is that each piece is an aliquot portion of the whole. The sixty-four pieces combined are exactly the size of an ordinary brick used in building. It is obvious that lessons in brick-setting and the elements of architecture can thus be readily given, and if the capital exercises suggested by Mr. Vacher in the accompanying handbook are followed—they are very easy—the little workman will gain largely in pleasure and profit. No better present could be found, in its way, for a child of a mechanical turn."—*The Bradford Observer.*

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ments, there is a distinct gain for after-life without any extra cost of brain power. It is for discipline rather than tuition—as a means rather than as an end—that Dr. Vacher has unbent himself from graver studies to devise a useful as well as innocent amusement for the young ; and for our part we do not think he could have occupied his spare moments more profitably. We heartily commend the toy as a suitable Christmas present."—*The Liverpool Mercury.*

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